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The Professor and the Business Man.

There have been signs during recent years of a breakdown of the antagonism traditionally felt by the man of affairs—commonly and accurately termed "the business man"—for the man of study—commonly and inaccurately termed "the professor"—and *vice versa*. It is an antagonism arising almost entirely from a failure of two sharply differentiated types to understand one another's points of view. We have always been the first to welcome any mitigation of this failure, for we are only too well aware how great is the need to-day for co-operation between industry and science. We regard it, therefore, as more than unfortunate that a certain professor of political science, speaking recently to a Rotarian conference, should have seen fit to criticise the modern business man in no measured terms. A speaker has, of course, a perfect right to address his audience in any manner that he may think fit and that they may tolerate. Further, it is widely appreciated that the methods and exigencies of newspaper reporting frequently give the general public an entirely deceptive idea of what has been said or done on a given occasion, either by the removal of remarks from their context or by the juxtaposition of sentences not originally related. Nevertheless, we venture to suggest that there are some things that should not be said by a responsible speaker on a public occasion, less on account of their immediate effect than on account of their ultimate repercussions. The gentleman in question has been widely quoted as saying that the profit-making motive seemed to him "a contemptible and dangerous thing," while the private life of the business man was not a thing for which the outsider could, in general, profess admiration. "He may be an excellent husband and a superb father, but he knows nothing in general of the intellectual heritage that is ours." And so on.

It would, of course, be easy enough to ridicule such remarks as unworthy of serious attention, and that, doubtless, has been the usual reaction. Unfortunately that cannot mend the mischief. For there are still a certain number of men imperfectly convinced of the benefits to be derived from co-operation with "the professors," and who will be only too glad to seize upon such evidence of the arrogant unpracticalness (if the word be permitted) of the type. For remarks of this kind give colour to the worst of the legends on the subject. Here is a professor at a university whose very existence is largely due to the generosity of men moved in the past by the "profit-making motive" he despises. Here is a professor, many of whose colleagues are among the most tedious and retiring of men in private life, sneering at the private life of the business man because he is preoccupied with bridge or golf. If all professors are like that, says the disgusted business man, let us have none of them.

But of course all professors are not like that, still less the numerous men of science and of thought who have never possessed a University Chair but are commonly and incorrectly awarded the title. Doubtless political science has its place in the world, although it is a place not always obvious to the lay mind. But it is worth remembering that the man of science, using the term in its strict sense—*i.e.*, the physicist, chemist, biologist or metallurgist—has even less use than the general public for studies of this kind, and even goes so far as to question the right of economists, psychologists, etc., to the name of scientist. It is to be hoped that these facts are to some extent appreciated, and that the unreasonable criticisms of the business man which we have quoted will be taken for what they are—the extravagances of an extremist, not the opinions of a class.

A Factor in Dividend Production.

During the recent Middlesbrough Convention we were fortunate in being the guest for a few hours at the home of one of the most important Tees-side foundry owners. Naturally, the conversation turned towards economic conditions within the foundry industry. On the question of dividends and orderliness of shop lay-out and of production it was agreed that wherever the latter was noteworthy, the former were invariably substantial, and in this connection our host related an interesting story. It appeared that, with another industrialist, our host once spent several months touring a large number of industrial concerns in France. On the conclusion of the tour they agreed to prepare separately a list of these works, basing the order of citation on individual forecasts as to which were the most prosperous from a dividend-paying aspect. The two lists were virtually the same, and it was soon revealed that the underlying basis of their guesses had been orderliness. Then reference was made to the "Echo de la Bourse," which confirmed in no unmistakable manner that their "order of merit" was in true alignment with the financial standing of the works visited.

We, too, have in the course of our career visited many hundreds of works both at home and abroad, and although we never carried out such a conclusive test as our Tees-side friend, we have invariably been impressed with the general truth of his observations, and indeed have expressed similar views in these columns. In this connection, however, there are a number of concerns which insist that they have insufficient funds to ensure adequate maintenance of buildings and plant, let alone providing labour, for "spring cleaning." To this we reply that there is no need for spring cleaning if the "house" is never allowed to become ingrained with dirt.

Finally, we want it to be realised that a test such as was made for industrial France by an Englishman, if reversed and made for Great Britain by a foreigner, would yield exactly the same result. Thus neatness is an essential to continuous financial stability, which is merely another way of saying that orderliness in works conduct and industrial progress are interdependent.

XUM

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Keighley Rates.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—My attention has been drawn to the statement contained in your JOURNAL for May 29 last, under the heading "Industrial House-Moving," that the rates in Keighley are 20s. 9d. in the £. This is a grave inaccuracy, the rates in the Borough for 1929-30 being 15s. 3d., with the exception of a small area in which the rates were 15s. 9d., and the rates for 1930-31 are 17s. 6d. and 17s. 9d. respectively.

As the statement you have made may possibly be detrimental to the Borough, and in order that you may correct your misstatement, I trust that you will give my letter the same publicity as you gave to the statement to which I have referred.—Yours, etc.,

S. WALKER,
Town Clerk.

Town Hall, Keighley.
July 2, 1930.

[We sincerely regret that this error crept into our columns.—EDITOR.]

Graphite in Cast Iron.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—The criticism of Dr. Norbury and Mr. Bolton of my suggestion that crystals of manganese sulphide act as nuclei for graphite precipitation fails on two grounds. On adding graphite or manganese sulphide to a supercooled melt the authors are on the horns of a dilemma. If they wait until the added material has dissolved, they have merely affected the chemical composition of the metal. If they cast shortly after making the addition, the graphite may or may not be on the same terms as the inherent graphite. The manganese sulphide certainly cannot be in the same physical condition as the inherent sulphide.

Crystallisation from a supercooled solution is markedly influenced by the form of the material of the nuclei. A parallel case is that of a liquid boiling in a beaker, when freshly-broken material facilitates smooth boiling, whilst well-rounded material does not.

The example quoted in Fig. 1 does not apply, because in iron with total carbon 2.53 per cent. there can naturally be only a relatively small amount of graphite to precipitate, which means fine graphite and greater difficulty in locating the nucleus in a plane section. It is obvious, I think, that the higher the carbon contents of any iron, the coarser the graphite.

With reference to graphite solution at 1,050 deg. C., I am prepared to concede, and hope to verify experimentally, that some graphite does go into solution at that temperature. In that case, what becomes of the graphitic nuclei theory when the metal is actually melted? Dealing with Fig. 4, the matrix appears to be the equivalent of a high-carbon steel violently quenched from a high temperature, and under these conditions the structure should be austenite and martensite, surely.—Yours, etc.,

A. ALLISON.

Sheffield,
June 30, 1930.

MINING & INDUSTRIAL EQUIPMENT, LIMITED, 11, Southampton Row, London, W.C.1, report that new orders have been received for the following equipment:—For England: A Hum-mer screen, for screening coal. For Sweden: Two Lopulco mills and a Raymond pulveriser, for grinding coal. For France: A Raymond pulveriser, two Raymond and three Hardinge mills, and a Hum-mer screen. For Tunisia: A Raymond super mill.

The Lancastria Club.

On Sunday morning, June 22, we were particularly fortunate. We had just crossed to Antwerp from Harwich, and our services were being utilised for the purchase of sundry essential articles for personal toilette omitted because (we were informed) of the rush due to the Middlesbrough Convention, when we found Mr. Paul Ropsy, Mr. Frank Russell and Mr. John Cameron in earnest conversation in the hall of the Century Hotel. We were immediately invited to participate in "joy day," organised by the Club Lancastria. We protested that we were ineligible, but we were reminded that though we had not made the crossing to New York, we had made some sort of a speech of "Bon Voyage" at Southampton. Thus we gladly took the opportunity of meeting once again so many of our friends from the Continent. Thus, together with about twenty-five or thirty leading lights of the foundry industry, including people of French, Belgian, German, Dutch and Italian nationality, we were transported in private cars to a small tugboat, which toured us through Antwerp's magnificent docks, Mr. Ropsy acting as guide and chaperone. Then there was a community luncheon, served in the Zoological Gardens Restaurant. At four o'clock, the real foundry enthusiasts, such as Mr. Jolley and the writer, accepted Mr. Ropsy's invitation to inspect his works at Merxlem, a suburb of the town. The works manufactures chilled-iron car wheels, utilising the Griffin system, chill rolls, and grain and other rolls for all sorts of industries. The temperature was pretty formidable, but the Lancastrians apparently are inured to the combination of rapid travel, works visits and banquets, and difficulty was experienced in getting them to leave the works in time to change for dinner.

By the time the banquet was served the weather had broken, and fears were expressed for the safe arrival of some of the late-comers. It was held at the Carillion d'Argent Restaurant, in a section of Antwerp's magnificent Exhibition called Vieille Belgique. This is a veritable village, constructed of replicas of houses and shops now existing in various towns in Belgium.

Mr. Paul Ropsy presided, and had on his right Mr. Frank Russell, who acts as convenor of the Club. It appears that other gatherings of a similar character had been held in Paris, when Mr. Montupet presided, and in London last year when Mr. Russell took the chair. The speeches in general brought up to date the doings of the "members." Young Mr. Montupet had been married, whilst Mr. Vanzetti junior had received his degree of doctor, and so on. Mr. Russell made the speech of the evening in French, and, by some extraordinary gift, managed to pay some appropriate compliment to every person present.

Following the banquet there was the inevitable dancing, speciality exhibitions being given by the wife of the only German member and Mr. Russell.

One might imagine that such an association as the Lancastria Club was just an international foundry excresence, but on closer acquaintance we realise that every member of it has friends spread over all Europe, upon whom he can rely to perform some personal service if needed.

Steel Specifications.—At a recent meeting of the American Iron and Steel Institute Mr. John Johnston read a Paper entitled "Some Comments on Steel Specifications," in the course of which he pointed out the limited value of chemical analyses. He thought this was largely due to the fact that, in most cases, only some of the elements were determined. The presence of small quantities of nitrogen, oxygen, etc., was seldom taken into consideration, nor traces of other elements which may exert considerable influence on the physical properties of the finished product.

Random Shots.

This week a little food for thought for the pessimists. My first quotations come from delegates to the recent Imperial Press Conference, than whom none can do more throughout the Empire to give a true picture of the home country. The leader of the Canadian delegation and vice-chairman of the Conference, Colonel J. H. Woods, of Calgary, spoke as follows:—

* * *

"Britain is as sound as a bell. That is the one big impression we have formed in our minds during our stay here. England is her own worst critic with regard to her prospects. Most emphatically she is not declining. This visit has revived our faith in the homeland."

* * *

Sir Stanley Reed, an Indian delegate, said that the two major impressions on his mind were "the strength and progress of Great Britain . . . an immense improvement in the standard of life. The hundreds of thousands of new houses, the better-dressed, the better-fed, better-educated folk of all classes. . . . A striving after greater industrial efficiency was manifest everywhere."

* * *

Mr. J. M. Keynes, the economist, spoke of our troubles as due not to failure or decay but to a malaise of wealth. We were saving money faster than we were finding means of spending it. We were finding means of saving labour faster than we were finding outlets for labour, giving the growing pains of progress, not the rheumatism of old age. We were raising the standard of life just a shade too fast.

* * *

He went on to say that we were four times as wealthy as we were a hundred years ago, and predicted that in another hundred years we should be eight times as rich as we are now. We were suffering some of the minor penalties of being a great pioneer in social equalisation.

* * *

I note that in some centres the trade representative of the U.S.S.R. (Russia), in speaking on the question of trade with Russia, has not been very favourably received. Wideawake firms will probably not lose the opportunity of opening negotiations for trade with Russia, particularly as the two Governments have decided to enter into negotiations with regard to the vexed question of debts between the two countries.

* * *

The Report of the delegation visiting the steel centres of the Continent, the Cotton Report, the announcement of a working agreement between Lister's and Ruston & Hornsby, the banker's memorandum on Free Trade policy and the Trades Union Congress Report on Trade policy, Empire relations and tariffs, have all conspired to make this a memorable week. I predict that things, when they do move, will move fast. We take a lot of teaching, but the sheer logic of events is having its effect.

* * *

MARKSMAN'S BULLS-EYES.

Pity the poor and bungalowly.

Both varieties of kitchen copper are now nearly extinct.

Some girls are not content to improve on Nature. They step in where Nature feared to tread.

A childish vulgarism might be modernised to run: "Teach your grandmother to drink cocktails."

MARKSMAN.

Conditions in the Continental Iron and Steel Industry.

REPORT OF THE BRITISH DELEGATION.

The Economic Advisory Council has issued the Report* of a Delegation on the "Industrial Conditions in the Iron and Steel Industries in France, Belgium, Luxemburg, Germany and Czecho-Slovakia." We append the following extracts:—

An introductory note points out that in order that the Committee of the Economic Advisory Council might have first-hand information with regard to the industrial conditions in the iron and steel industry in France, Belgium, Luxemburg, Germany and Czecho-Slovakia, a Delegation visited these countries. The information obtained as the result of the visit is given in the Report separately in respect of each of the countries. The members of the delegation included Mr. John A. Gregorson (General Secretary of the British Iron and Steel Trades Employers' Association), on behalf of the National Federation of Iron and Steel Manufacturers; Mr. R. Dennison (Assistant General Secretary of the Iron and Steel Trades Confederation); Mr. E. C. Ramsbottom (Director of Statistics, Ministry of Labour) and Mr. F. S. Flint (Overseas Section, Statistics Division, Ministry of Labour). The Delegation left London on January 20, and returned to London on February 14, 1930, having, in the meantime, interviewed Government officials, employers' organisations and trade unions, and visited a considerable number of the principal iron and steel works in the five countries.

FRANCE.

War Position.

Between 1914 and 1919, as a consequence of the war being carried on in the principal ore and metallurgical area of France, the national industry was deprived of 64 per cent. of its then pig-iron capacity and 62 per cent. of its steel capacity. The delegation were informed that 85 blast furnaces fell into German hands out of 170; 48 Martin furnaces out of 164, and 53 Bessemer converters out of 100. Immense efforts had to be made to increase capacity in the non-war areas, with the result that Martin furnaces in these areas were increased by 100 per cent., converter furnaces by 102 per cent., electric furnaces by 90 per cent. and crucible furnaces by 105 per cent.

Post-War Position.

After the termination of the war, the works destroyed during the war were rebuilt and extended. In doing so, most modern plant was installed, and, to-day, the position in France is that the capacity has been considerably increased as against pre-war, due not only to the development during the war consequent upon the occupation of Northern and Eastern France, but also to the reconstruction and modernisation, since the war, of the plant in Northern and Eastern France. In addition, under the Treaty of Versailles, Alsace-Lorraine was returned to France, and in this area there was produced in 1913—3,870,000 tons of pig-iron, 2,286,000 tons of steel and 21,000,000 tons of iron ore. The net result of these transformations is that France possesses greatly enlarged equipment, completely renovated in most respects, and operating in a much wider geographical area.

A factor which was found to have been of great assistance to the French iron and steel industry in its competitive position was the receipt of large sums from the State as compensation for war damages. The industry was further assisted by the depreciation of the franc after the war.

* Published by His Majesty's Stationery Office, Adastral House, Kingsway, London, W.C.2, price 9d. each.

Labour Position.

No unemployment was found. On the contrary, there is a definite shortage of labour. The delegation were informed that about 200,000 foreign workers have been brought into the iron and steel and metallurgical industries (including ore mines). By nationality, these workers were found to be principally Poles, Italians and Belgians. At the works visited, it was found that the percentage of foreign labour employed ranged from 50 per cent. to 75 per cent., and averaged about 60 per cent. of the total workers employed. In 1923, the Federation of Mining, Metallurgical, Engineering and Allied Industries established an organisation for meeting the increased shortage of labour in France and arranging for the introduction of foreign labour.

No effective organisation of the workers in the industry, as there is in Great Britain, is to be found in France; in so far as it does exist, it has only a minor influence in the iron and steel industry. As there is practically no organisation of the workers, collective bargaining and collective agreements, such as prevail in the British iron and steel industry, do not exist in the industry in France, wage contracts and contracts of service being made between the employer and the individual workmen. The systems of payment of the workers vary from works to works and with the various classes of workers.

Wages.

No statistics of earnings, official or otherwise, are either published or available. Due to the non-existence of effective organisation among the workers, and the absence of collective agreements, or of any system of standardised wages, there is a variation in earnings in different districts and from one works to another. It was stated that while there is a large proportion of foreign workers employed, their importation has not resulted in depressing wages. Nevertheless, their existence is an important factor in the wages situation in that the scarcity of labour might otherwise have resulted in higher wages.

As the result, however, of the investigations made by the Delegation, sufficient information was obtained from the employers' central organisation, the trade union, and the works visited, to arrive at a trustworthy estimate of the total normal weekly earnings (inclusive of family allowances and other social allowances paid in cash) of skilled, semi-skilled and unskilled workers, as follows: Skilled men, 320 frs. (51s. 6d.); semi-skilled men, 250 frs. (40s. 3d.); unskilled men, 200 frs. (32s. 2d.). Rate of exchange—124.21 frs. equals 20s. A calculation of the total normal weekly earnings (inclusive of family allowances and other social allowances paid in cash) of all classes of workers at iron and steel works, on the basis of the data available, gives an average of 230 frs., equivalent to 37s.

Family allowances generally range from 1 to 1¼ frs. a day for a wife, with similar amounts for the first child and increasing amounts for the second and subsequent children. On an average, the family allowances and other social allowances paid in cash may be taken to add about 5 per cent. to the workers' earnings, and this percentage has been included in the figures as to earnings quoted above. The Delegation ascertained that houses are provided either rent free or at reduced rents to a large proportion of the married men employed by many firms, and lodgings at low rents for many of the unmarried men.

Hours of Work.

Hours of work are regulated by the Act of April 23, 1919. The Act is applied to the various industries by means of public administrative decrees. Hours of work for all persons in the iron and steel industry are regulated by a decree of August 9, 1920, as amended in 1923, 1924 and 1926. The principle of the decree regulating hours of work is an 8-hr. day or 48-hr. week, or, in the case of continuous processes, a 56-hr. week. Undertakings may adopt one of two methods of applying the decree—(*a*) limitation of effective work to a maximum of 8 hrs. per working day in each week, or (*b*) distribution of the 48-weekly working hours unequally between the working days (subject to a maximum daily limit of 9 hrs.) in such a way as to admit of a Saturday afternoon rest.

A number of temporary and permanent extensions of hours are permitted under the decree. The temporary extensions are for urgent work to prevent impending accidents, for salvage purposes or to repair damage to the machinery, plant, or buildings of the undertaking; work carried out in the interests of national safety or defence, or for the public service; urgent work with which an undertaking has to deal (exceptional influx of work), the allowance of extra hours in this case being 100 hrs. a year. In addition, a further extension up to a maximum of 40 hrs. a year is allowed to make up time lost through any general stoppage of work for the observance of local holidays or other local events established by custom. In the event of a general stoppage of work due to accident or *force majeure*, the working day may be extended to 10 hrs. for a limited period to make up the time so lost. Throughout the industry the shift system of working is in force.

In connection with blast furnaces the total normal average weekly hours of effective work, *i.e.*, 8-hr. shifts over 7 days, is 56; melting shop (Bessemer converter and open-hearth), (7 p.m. Sunday to 6 a.m. Sunday), 51⅔ hrs., or (4 a.m. Monday to 6 a.m. Sunday), 48⅔ hrs.; rolling-mills (6 a.m. Monday to 6 a.m. Sunday), 48 hrs.

As regards overtime rates of payment, the custom varies from works to works. At some works only ordinary rates are paid. At other works the overtime extra varies from 25 or 50 per cent. on weekdays to 100 per cent. on Sundays.

BELGIUM.

War Position.

In 1913, the production of pig-iron in Belgium was 2,485,000 tons, and of steel ingots and castings 2,467,000 tons. During the war most of the principal works in Belgium were systematically dismantled by the Germans and the equipment and plant transported to Germany. At the end of the war, therefore, although a considerable quantity of plant which had been transferred to Germany was recovered and reinstalled, most of the large works were incapable of producing iron and steel in any quantity until the plants had been reconstructed and modernised.

Post-War Position.

Due to reparations, State aid and new capital issues, the Belgian works have been re-established and equipped with the most modern plant. The effect of this is to augment very substantially the productive capacity of Belgium. While, in 1919, only 250,600 tons of pig-iron and 333,600 tons of steel were produced, this has gradually increased to 4,097,000 tons of pig-iron and 4,134,000 tons of steel in 1929.

Labour Conditions.

There is little or no unemployment in the iron and steel industry. In the iron and steel industry a number of foreigners—mostly unskilled workers at blast furnaces, in steel-melting shops and rolling-mills—are employed. The large majority of the workers, however, are Belgians. About 60 per cent. of the workers are organised

in trade unions, the majority being in the Belgian Metal Workers' Trade Union. Organisation in trade unions, however, differs from organisation in British trade unions, inasmuch as no collective agreements exist, and the negotiations with regard to contracts of service and wages are made between the employer and the individual worker. There exists a mixed commission, consisting of a president, nominated by the State, and representatives of the employers and workers. The nominations to the commission of the employers' and workers' representatives are made by the representative employers' and workers' organisations. The commission has nothing whatever to do with the fixation of wage rates—it only deals with the general wages situation. The decisions of the Commission are not binding on the parties.

The systems of payment of the workers vary not only from works to works but as regards the various classes of workers. In some cases, a rate per hour or per day is paid. In other cases, there is a basic rate with a tonnage bonus interest in production.

Wages.

No statistics of earnings, official or otherwise, are either published or available. As contracts of service and wages are made between the employer and the individual workman, there is no system of standardised wages. As the result, however, of the investigations made by the Delegation, sufficient information was obtained from the Ministry of Labour, the employers' organisations, the trade unions and the large works visited, to arrive at a trustworthy estimate of the total normal weekly earnings (including family allowances) of skilled, semi-skilled and unskilled workers as follows:—Skilled men, 470 fcs. (53s. 9d.); semi-skilled men, 340 fcs. (38s. 10d.); unskilled men, 270 fcs. (30s. 10d.). Rate of exchange:—175 fcs. equals 20s. A calculation of the total normal weekly earnings (inclusive of family allowances) of all classes of workers at iron and steel works, on the basis of the data available gives an average of 310 fcs., equivalent to 35s. 5d.

The only law which exists in Belgium with regard to family allowances is the Act of April 14, 1928, which came into force on October 20 of that year. The Act imposes on all firms desirous of participating in certain public contracts the obligation of joining a compensation fund (*caisse de compensation*) for family allowances, which must comply with certain conditions before being approved by the State. A compensation fund, in order to secure approval, must ensure a monthly payment to each child under fourteen years of age of at least 15 fcs. for the first child, 20 fcs. for the second, 40 fcs. for the third and 80 fcs. for the fourth and each subsequent child. This scale may be reduced when the charges exceed 3 per cent. of the total wages and salaries paid by the members of the fund. State schemes of social services (unemployment insurance, health insurance, old age pensions, poor relief, etc.) have not been developed in Belgium to the same extent as in Great Britain. Unemployment insurance is voluntary. In the iron and steel industry, voluntary family allowance systems exist at many works. It was ascertained that family allowances in the iron and steel industry cost the employer about 2 per cent. of the wages bill.

Hours of Work.

Hours of work are regulated by the Act of June 14, 1921, which came into force on October 1, 1921. The Act applies to industry generally, including the iron and steel industry. The Act prescribes that normally "the duration of effective work shall not exceed 8 hrs. a day nor 48 hrs. a week." A Royal Decree, dated June 11, 1923, issued under Article 4 of the Act of July 17, 1905, provides that "In blast furnaces, in works where different kinds of furnaces, converters, pots, etc., are used for the manufacture of iron and steel, and the extraction and refining of metals other than iron, and in rolling-mills for different metals, the workers engaged in processes the execution of which, by reason of their nature, cannot be interrupted, as well as the workers whose work is connected with that of the aforementioned workers, shall have a rest period of 24 consecutive hours at least once every three weeks." The intention of these provisions appears to be that workers, whose normal week is on an average 56 hrs., are to have one Sunday off every three weeks, and, in addition, 26 days compensatory holidays per annum. Throughout the industry the shift system of working is in force. It was found that the prevailing practice is to work three 8-hr. shifts, or, if the state of the order-book does not warrant three shifts, two successive 8-hr. shifts are worked.

It was found, from information obtained from the Ministry of Labour, the central employers' organisations, the representative trade union officials, and a visit to one of the largest works in Belgium, that the usual starting and finishing times in respect of each department and the total average normal weekly hours of effective work were as follow:—In connection with blast furnaces the total average normal weekly hours of effective work (8-hr. shifts over seven days) is 56 hrs.; electric furnaces, Bessemer converters and open-hearth melting shops (6 p.m. Sunday to 6 a.m. Sunday), 52 hrs.; rolling mills (6 a.m. Monday to 6 a.m. Sunday), 48 hrs.

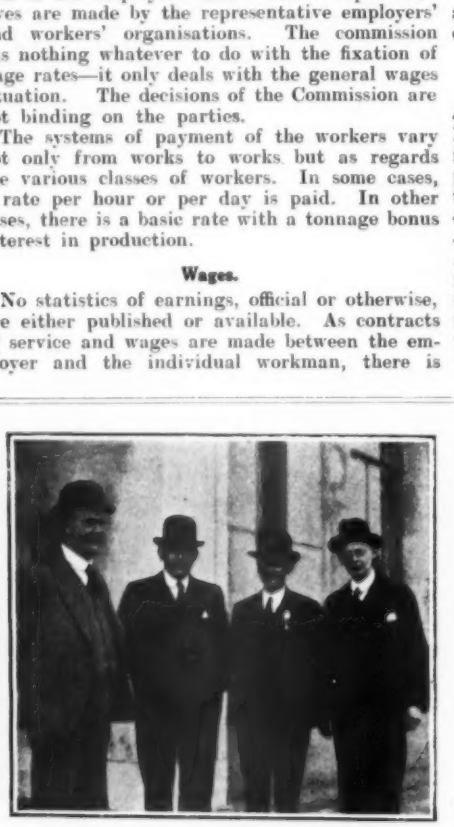
Under the provisions of the Belgian Act regulating payment for overtime, the rate is 25 per cent. above the ordinary rate for the first two hours, and 50 per cent. for succeeding hours, with 100 per cent. on Sunday. It was ascertained that overtime extras are calculated on a daily basis. The ninth hour permissible on any day, when a Saturday afternoon holiday with a 48-hr. week is observed, does not appear to be overtime, nor the ninth and tenth hours permissible on any day when the work is organised in successive shifts and the 48-hr. weekly average is maintained. Apart from these exceptions, the general intention of the Act seems to be that all hours, for whatever reason worked, above 8 a day or 48 or 56 a week (on continuous processes) should carry the increased rates.

(To be continued.)

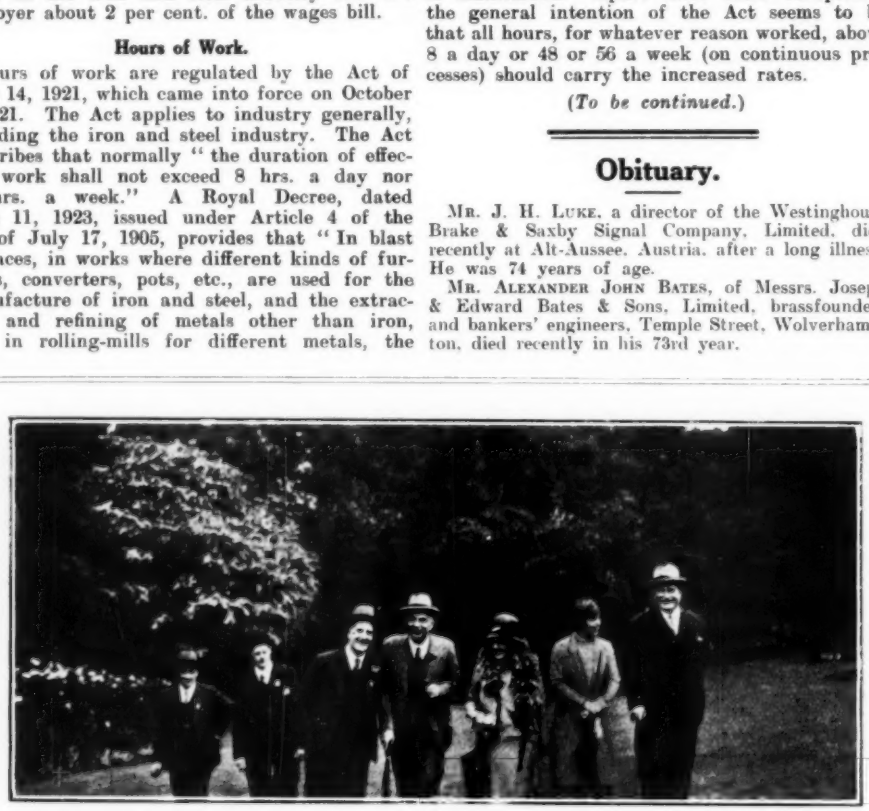
Obituary.

Mr. J. H. Luke, a director of the Westinghouse Brake & Saxby Signal Company, Limited, died recently at Alt-Aussee, Austria, after a long illness. He was 74 years of age.

Mr. Alexander John Bates, of Messrs. Joseph & Edward Bates & Sons, Limited, brassfounders and bankers' engineers, Temple Street, Wolverhampton, died recently in his 73rd year.



Four Recipients of the Oliver Stubbs Medal:—Mr. J. Shaw, Mr. F. J. Cook, Mr. J. Ellis and Mr. A. Campion.



At Overdene, Saltburn-by-the-Sea. In the group are shown (left to right) Mr. Wares, Mr. Campion, Mr. Harley, Sir William Fawcett, and Mr. Shaw, who was host to the visitors at the Middlesbrough Convention.

The death of Mr. Thomas Muirhead occurred at his residence in Falkirk on July 1. Mr. Muirhead was in his 71st year, and he celebrated his jubilee as a foreman in the Camelon Iron Company in April, retiring about a month later.

Mr. Thomas Scott, who was for 40 years works manager of the Callendar Iron Company, Limited, Falkirk, died on July 2. Mr. Scott was 73 years of age, and began his foundry career as an apprentice patternmaker in the Old Union Foundry, belonging to Messrs. Crosthwaite & Company, Limited. He next served as a patternmaker with the Falkirk Iron Company, and then went to the Callendar Iron Company as foreman patternmaker, being later appointed works manager.

Contracts Open.

Glasgow, July 26.—40-ton electric coaling crane and six 5-ton semi-portal electric cranes, for the Clyde Navigation Trust. Mr. D. Fife, mechanical engineer, 16, Robertson Street, Glasgow. (Fee £3 3s., returnable.)

Johannesburg, July 19.—Four 6-ton steam wagons, four 4-ton trailers, and one 10-ton road roller, for the City Council of Johannesburg. The Department of Overseas Trade. (Reference A.X. 9,773.)

Loughborough, July 14.—Pumping plant, etc., for the Town Council. Mr. W. Granger, borough surveyor, Town Hall, Loughborough. (Fee £2 2s., returnable.)

The Liége Foundry Convention.

It should be clearly understood, *ab initio*, that the International Foundry Conference was auxiliary to the Seventh International Conference of Mining, Metallurgy and Applied Geology, which created two types of functions—one being where the foundrymen were part and parcel of the major function, and the second where they functioned as a separate entity. Thus the opening ceremony on the Monday morning was common to every section, as was the reception in the evening and the banquet on the Wednesday night. Moreover, in some of the works visits, notably that to the Cockerill foundries. This intermittent co-operation was ameliorative rather than detrimental, and gave the leaders of the foundry industry the opportunity of meeting leaders in allied activities. Notable amongst these were Sir Holberry Mensforth, of Messrs. Dorman, Long & Company (a firm which acted as hosts to the foundrymen only the previous week), Prof. Henry Louis, President of the Iron and Steel Institute, and Dr. Seligman, President of the Institute of Metals.

Mr. J. Léonard, works manager of the Grivegnée Section of the Angleur-Athus Company, presided with great distinction over the foundry section. He and the honorary secretary, Mr. Deprez, are to be congratulated on the excellence of their organisation. The meetings were held at the centrally-situated University buildings. Here one registered with a minimum of effort, and, considering that a dozen nationalities were participating, it reflects great credit on the organisation. As usual, Mr. Makemson was of great service to his compatriots. He and two of the Past-Presidents of the Institute of British Foundrymen, Mr. J. Cameron, J.P., and Mr. V. C. Faulkner, were made official delegates to the Conference.

Tuesday, June 24.

The technical sessions were excellently attended, but owing to the number of Papers, thirty-one in all, the proceedings were somewhat rushed. The first session was given over to the newer methods of testing, which usually involve the trepanning of small bars from actual castings and testing them by shearing, punching and breaking transversely. We were impressed by the remarks of a metallurgist attached to the French marine, who stated that the results obtained when using various types of machines were not comparable. This seemed to us rather a disquieting assertion, for, after all, if the technical conditions of the test-bar are known, tensile, transverse and Brinell results are readily appraised whether the test be conducted on an Avery, Buckton or Amsler or any other type of machine. Owing to language difficulties the British were mute, but actually the discussion was a continuation of that initiated in London last year.

Later on in the session Mr. J. Deschamps' Paper was presented personally, but lack of time prevented adequate discussion. As we said elsewhere last week, the holding of simultaneous sessions is the sole solution to this vexed question of inadequate discussion.

The afternoon was devoted to works visits, and practically the whole of the British delegation, which numbered about forty, chose the Cockerill foundries. These are amongst the most modern in Europe, and have previously been described in our columns. Great attention is given to the instruction of the apprentices, who are housed in a separate bay. The castings made are of the highest quality, whilst the internal transport arrangements are worthy of emulation by the vast majority of large jobbing foundries. The foundries cover a total area of about 8 acres, and the iron foundry has 10 side bays, each measuring 50 yd. by 16½ yd., and a centre bay of about 90 yd. by 22 yd. At one end of this centre bay there are five cupolas, the total capacity of which is 40 tons per hr. Entirely modern moulding machines are installed for the moulding of both iron and steel castings. Castings weighing up to 120 tons are produced, and the annual production exceeds 20,000 tons.

In the evening a reception was offered by the Mayor and aldermanic bench at a hall situated in the southern section of the Exhibition. A brilliant company assembled, and it was obvious to the observer that constant contact has made the founders of all nations well known to each other, and there was exhibited a camaraderie still foreign to the mining and metallurgical experts.

Wednesday, June 25.

Early in the second session Dr. Norbury presented his thesis on "Factors which Influence the Chilling Properties of Cast Iron." He came in for a certain amount of criticism from Mr. Portevin and Mr. Le Thomas, but there was a good deal of general support for his views.

When Dr. Geilenkirchen, Editor of *Die Giesserei*, presented his Paper on "Furnaces utilised in the Grey-iron Foundry," he used an electric torch, throwing the shadow of an arrow for explaining his lantern slides instead of a pointer. This impressed us as being a distinctly useful novelty. His Paper emphasised to some extent the development of the Brackelsberg furnace, which subject was again dealt with by Dr. Stotz on the following day. Unquestionably this type of furnace is creating a maximum of interest amongst the malleable-iron founders on the Continent. In the discussion, Mr. Ronceray expressed a preference for a combination of cupola melting and electric refining.

In the afternoon, though there was a visit to the laboratories of the Fabrique Nationale des Armes, many of the visitors made a second visit to the Exhibition. This was extremely interesting from the heavy industries point of view, but we only saw one actual foundry-equipment stand—that of Messrs. Ketin et Thiriart. Exhibits of actual castings, however, were of exceptional interest, as, for instance, a roll made by Mr. Varlet at the Esperance Longdoz Company. It was for squeezing sugar cane, and possessed on the surface the coarsest possible grain, which we gathered was an essential for this particular duty.

The evening was taken up by an official banquet, at which Mr. Vanzetti (Italy), the President of the International Foundrymen's Committee, voiced the thanks of the industry, over which he has presided with such great distinction this last year.

Thursday, June 26.

Sessions were held during both morning and afternoon, but we are afraid they were rather neglected by the British. This was because a number of Belgian foundrymen were kind enough to invite private parties of Britishers to their works, and in this connection we would specially mention Mr. Masson (of the Fonderies de Chênés) and Mr. Varlet (of the Esperance Longdoz). Other residents in Belgium, who were the essence of kindness to the British visitors, were Mr. Paul Fassotte, who was host at a charming little private dinner party held in a country inn about 8 miles from Liége; Mr. Crawshaw, a Britisher long resident in Belgium, and Mr. Monseur (whom the guests promptly christened "Monty"), who devoted every minute of the day (and half the night) ministering to their needs. Of the Belgian officials, Mr. Foulon and Mr. Ledent were indefatigable in their efforts to render personal services to the guests.

The foundrymen held their own banquet in the evening, and much of the formality of Wednesday was dispensed with. Mr. Léonard presided, and had as his principal guest, Prof. Fourmarier, the President of the major conference. The first to voice the thanks of the guests to their hosts was Signor Carlo Vanzetti, C.B.E., in his capacity of President of the International Committee. He announced that Mr. Damour had that afternoon been nominated President-elect, and would direct the work of the Committee in 1931, whilst the British had been asked to nominate a President for 1932. He further announced that the next international meeting of foundrymen would be held in Milan in the autumn of next year, and cordially invited everybody to participate.

Mr. Damour was the next speaker. He is the President of the French Foundry Technical Association and an important foundry owner. Then came Dr. S. G. Werner, the President of the German Foundry Owners' Federation, who in the most diplomatic French indicated that his colleagues had found it impossible to carry out their original intention of holding the Fourth International Convention in Germany in 1932, but hoped to stage one a little later. We are sure that the British will sincerely sympathise with the Doctor that economic conditions are so bad as to make postponement an essential. Mr. Cameron was the next speaker, and he strongly emphasised the great value to be derived from international contacts and personal friendships made on these occasions. Speeches by Mr. España (Spain) and the representatives of Czecho-Slovakia, Luxemburg and Holland wound up the oratory, which gave place to dancing until the early hours of the morning. Even then many of the indefatigable British found more pleasure in the cabarets than in sleep.

Friday, June 27.

At nine o'clock, the usual hour for starting conference work in Liége, the party gathered at Quai des Etats Unis, and were assembled in motor coaches and private cars for a tour through the Belgian Ardennes. Luncheon was served at the Hotel Britannique at Spa, whilst for tea the whole company were the guests of Mr. Piedbœuf at his house—the Château d'Embourg. The château is delightfully situated at the crest of a hill, and the welcome they received from Mr. and Mrs. Piedbœuf was charming and cordial.

We have attended a considerable number of international congresses, but the one organised by the Belgian Foundrymen's Technical Association was outstanding in the warmth of its welcome to its guests, the perfection of its organisation and the personal charm of its principal officials.

Continental Steel Cartels.

It is understood that at the recent meeting of the managing committee of the Continental Steel Cartel, in London, it was decided to continue the present rate of restriction in the output of the various groups. This decision, however, is only of formal importance, as the actual output of steel ingots is below the officially fixed quotas. It was also resolved to maintain for the current quarter the official prices which were arranged in the middle of February. The Committee is said to have now approved a second group of British merchants, who are to receive a commission of 1s. per ton on their turnover on all products except semi-finished steel, for which a special organisation is under consideration.

The International Rail Makers' Association (Irma), the members of which recently met in London, decided to make no change in prices for the current quarter. The situation on the rail market was characterised as weak.

The Continental Wire Rod Syndicate is checking the prices of the individual members. The European market is said to have hardened slightly recently.

THE LIVERPOOL NAIL COMPANY have removed from 83, Westmorland Street to 29, Argyle Street, Liverpool.

E

Methods of Moulding Castings for Stoves, Heating Apparatus and Various Builders' Castings.*

By H. Magdelenat, Vice-President, French Foundrymen's Association.

[French Exchange Paper.]

Introduction.

In covering the subject-matter of this Paper a description is given of the methods of moulding a pedestal stove, certain cooking-range parts, a skylight frame and a sink.

One example will be given of each method of moulding, viz.: (1) Bench or loose pattern—a pedestal stove; (2) machine—flat heating-apparatus castings and skylight frame, and (3) plaster pattern—a sink.

ditions are necessary: (1) That the primary movements of which it is composed shall be carried out without stoppage and without the object operated upon being subjected to further handling, *i.e.*, continuity of manufacture; (2) that the workmen as well as the mechanical means employed shall operate uninterruptedly, *i.e.*, continuity of action.

It is this principle of continuity in its dual aspect that underlies the conception and development of the Rosières-Bachon patent continuous moulding machine, which in itself really constitutes a complete continuous moulding shop.

For some time past, many foreign foundries, particularly American, as well as a certain number of French works, have already applied the continuous principle in manufacture by placing the moulders with their machines along side lines of conveyors of various types, on which the moulds are arranged at the pouring and stripping points. On the other hand, continuity of action in foundry work is much less observed.

It is still very common, for example, to see the moulder mould, pour, strip and renew his sand himself. That is to say, he carries out a series of operations which are essentially diverse, in the course of which the sequence of his labour is subjected to interruptions detrimental to output. The operations, moreover, do not succeed one another uninterruptedly, either because he is attending to the liquid metal when his moulds are ready, or because at a particular moment he requires the help of others to carry out some movement or operation. This discontinuity of action is also strikingly apparent in the operation of most of the hydraulic, pneumatic or hand moulding machines. If one actually measures the time corresponding to the primary movements required in the preparation of a mould it is apparent that the time employed in ramming the sand—the essential function of the machine—is generally a very small fraction of the total time. That is to say, the machine is doing nothing whilst the moulding box is being put in position, whilst it is being filled with sand, whilst the sand is being given a preliminary tucking around the more delicate parts, whilst the excess is being struck off, whilst the moulding box is being removed, etc.

In the Rosières-Bachon continuous moulding machine the members have been combined so

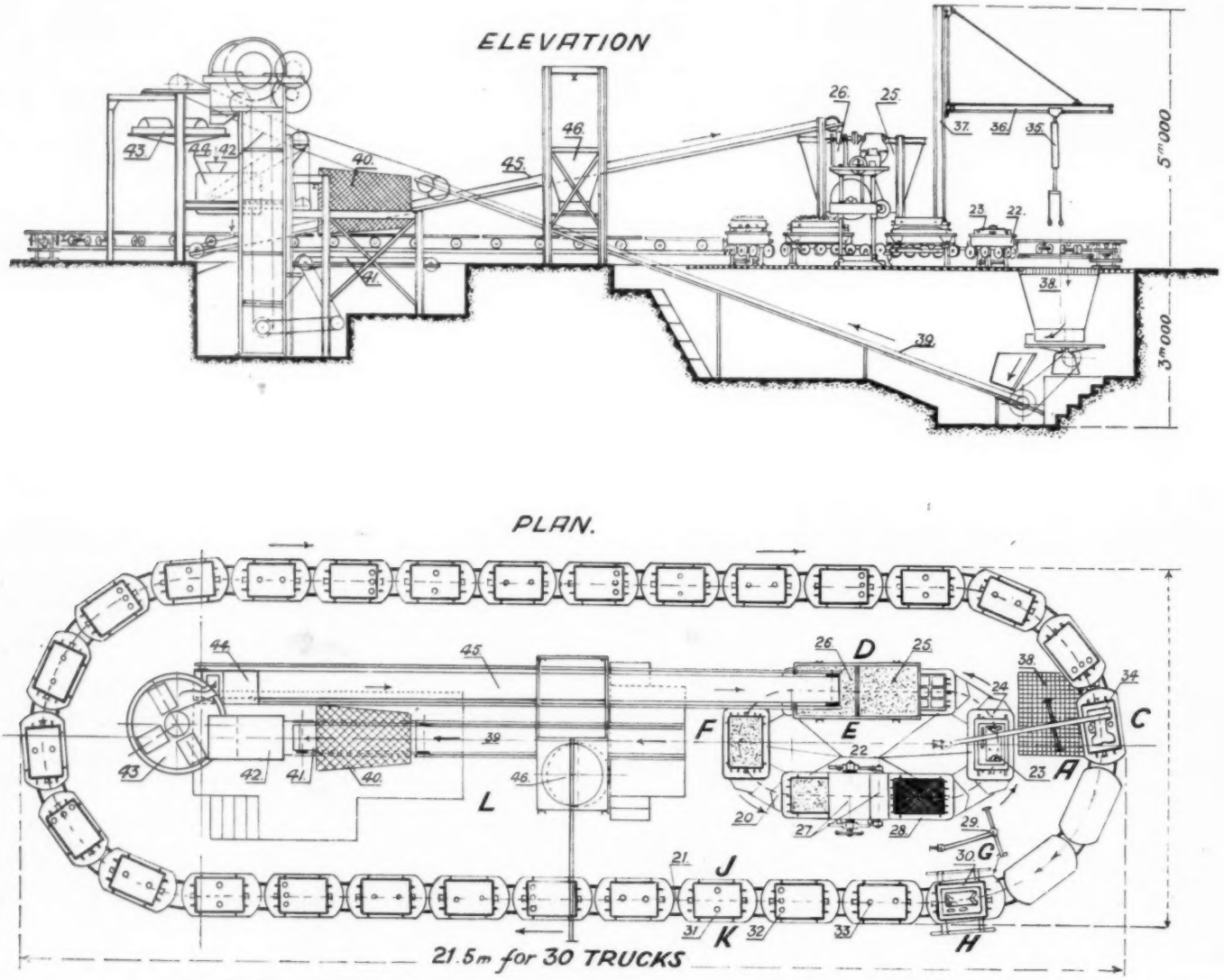


Fig. 1.—Plan and Elevation of the Rosières-Bachon Continuous Moulding Machine Lay-out.

The writer wishes to express his indebtedness to the Société du Familistère de Guise, the Anciens Etablissements Génevée, the Etablissements Bonvillain & Ronceray and the Usines de Rosières, who have very kindly supplied him with the information embodied in the Paper.

Rosières-Bachon System.

To carry out any industrial operation to the best advantage the following, *inter alia*, con-

* Part of a Paper presented at the Annual Convention of the Institute of British Foundrymen.

that each primary movement, whether human or mechanical, considered by itself, is repeated without interruption and is effected as rapidly as possible. This naturally implies as perfect synchronisation as possible between these various movements, but the allocation of each member to its particular function and of each man to his particular duty enables the maximum efficiency to be obtained. Moreover, the fact that the work done by the operators is dependent upon the action of the various machines has the advantage of enabling the rapidity of their labour to be suitably fixed.

Uses.

The Rosières-Bachon continuous moulding machines were designed for the repetitive production of flat and slight relief castings. At present there are two types for large moulding boxes, the inside dimensions of which may vary from 28 × 20 × 4½ in. to 48 × 33 × 4½ in. The first type, with six strippers, is particularly suitable for moulding castings for heating apparatus: kitchen ranges, ovens and stoves of any dimensions. The second type, with eight strippers, has been produced specially for moulding radiator units. It differs from the first type only by the addition of the two strippers. Finally, a third type for small moulding boxes (24 × 20 in. and less) and capable of moulding double-sided pattern plates is shortly to be produced.

Description.

The accompanying plan, Fig. 1, shows the installation of a machine of the RB2 type with six strippers. The moulding machine proper is detailed in Fig. 2.

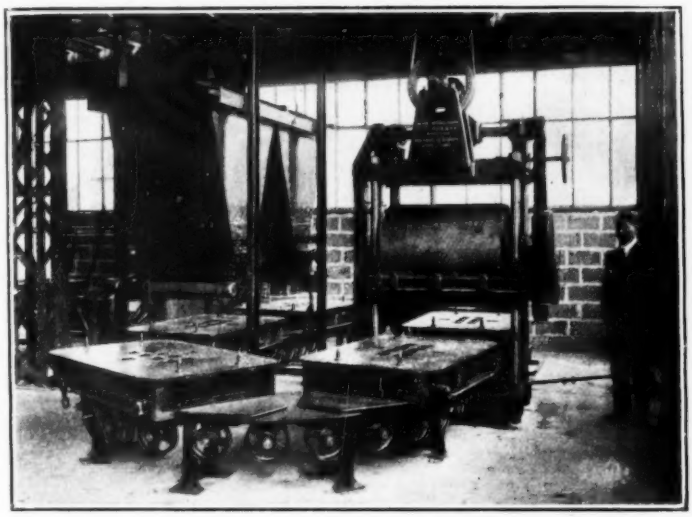


FIG. 2.—THE MOULDING MACHINE PROPER, TYPE RB2, WITH SIX STRIPPERS.

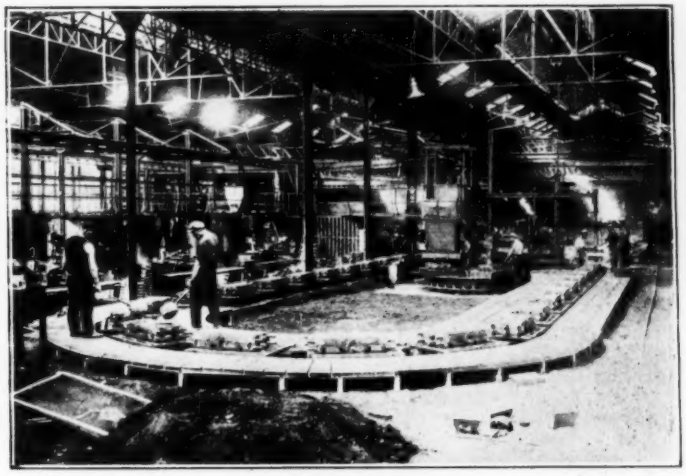


FIG. 3.—GENERAL VIEW OF THE MOULDING SHOP HOUSING THE FIRST CONTINUOUS MOULDING MACHINE OF THE TYPE RB1.

The views shown in Figs. 3, 4, 5 and 6 illustrate the shop installation of the first continuous machine of the RB1 type, which was shown at the International Foundry Exhibition in Paris in 1927, and which has since then been constantly at work at the Rosières Foundries. The sand plant which feeds this RB1 machine is outside the shop.

The moulding machine proper necessarily comprises a conveyor for finished moulds ready for casting and cooling the castings before stripping, and, of course, a sand plant with a large output (15 to 20 cub. metres an hour).

The chief mechanical features of these continuous moulding machines, which have been granted French and foreign patents, are:—(1) The ramming of the sand by multiple rollers, (2) the method of effecting the movement of the strippers and the conveyor trolley in an endless circuit.

The working of the machine will be better understood with the aid of Figs. 7, 8 and 9, showing the patterns used and the castings obtained simultaneously during a single period of work (the same patterns were previously used for moulding in hydraulic machines). These views are supplemented by Fig. 10 for the purpose of showing that small castings can be moulded advantageously in large boxes.

The whole machine comprises a moulding circuit proper (20) and conveyor (21) for finished moulds (see Figs. 1 and 3). The moulding circuit takes strippers (22) on which the pattern plates (23) are fixed. One stripper carries the pattern plate corresponding to the bottom part of a mould, and the following one that corresponds to the upper part. The moulding cycle, therefore, produces three complete moulds for different castings in each revolution.

When the machine is working the moulding unit and the conveyor work in opposite directions. When a stripper passes at (24) an empty moulding box, taken from (34), is placed on the pattern plate (23) which it carries; this stripper then passes beneath a first hopper (25) filled with sand, the bottom of which it opens,

FIG. 4.—CONTINUOUS MOULDING MACHINE, TYPE RB1.

The box, automatically stripped at the exit of the sand-compressing rollers, is being lifted by a pneumatic block.

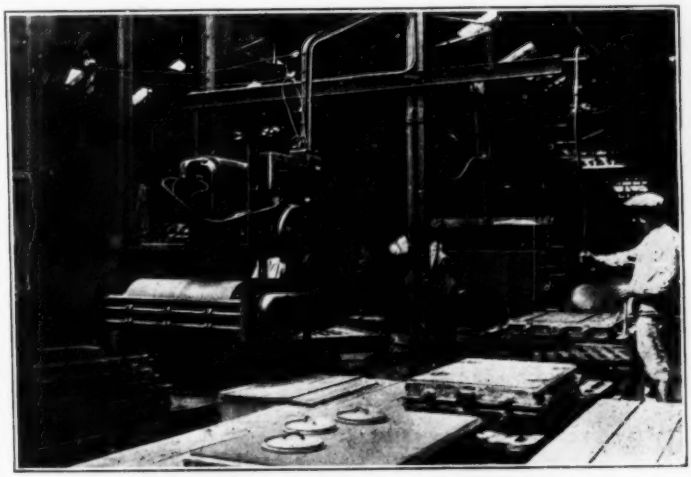


FIG. 5.—CONTINUOUS MOULDING MACHINE, TYPE RB1.

View of the Assembling Station on the moving conveyor. The bottom box rests on the arm of a pneumatic piston; the top box is suspended from a pneumatic block, will be placed on the lower half by the use of this hoist, and the finished mould will continue on the conveyor carriage.

this being closed again automatically after a definite quantity of sand has been discharged. The sand constituting the first filling of the box is rammed by hand beneath the bars and against the sides (see Fig. 6). Continuing its course, the stripper opens the bottom of the second hopper (26), which closes automatically after having released sufficient sand for the final ramming of the box. The sand is regulated mechanically to a suitable height over the box. The stripper then passes beneath the two or three pressing rollers (27), and on reaching (28) strips the moulding box mechanically and automatically (see Fig. 4), keeping it lifted sufficiently long while travelling to permit of its being easily caught by a pneumatic hoist on the crane (29). The bottom of the box is taken first and is turned over 180 deg. while suspended in the hoist at (29), whereupon it is placed at (30) on four supports connected with a pneumatic piston (see Fig. 5). The hoist is returned to (28) to take the top part, which has followed the bottom part, in order to undergo the same series of operations. Having been brought to (30), the top is assembled over the bottom part, and the complete mould is lowered by the pneumatic piston on to one of the plates of the conveyor, which carries it away.

Mr Magdelenat, Author of the French Exchange Paper, is a Vice-President of the French Foundry Technical Association.

These are the various stages in producing a complete mould. The same operations are repeated without interruption for manufacturing a series of moulds in moulding boxes of the same type. When the moulds are finished they are cast at (31), (32) and (33) on the conveyor, which carries them slowly round to (34), where each part of the moulding box is taken up, knocked out over the grating of a hopper (38) and again placed on the pattern plate of the stripper at (24). Small boxes to be stripped are taken up by hand by two men; those of large dimensions are taken up by a pneumatic pulley block (35) mounted on a monorail (36) pivoting on the column (37).

Immediately the top part of the mould has been taken at (34) the casting and its runners are removed and placed on a special conveyor (not shown in the plan) which takes them to the fettling station. The speed of the conveyor is regulated by that of the moulding circuit, so that one plate passes at (30), while two strippers pass at (28). Its length is dependent on the cooling time required by the castings. In practice a conveyor consisting of 30 units is amply sufficient for heating-apparatus castings.

The entire moulding and mould-conveyor circuit is driven by a single low-power electric motor (about 4 h.p.). The consumption of the two hoists and the pneumatic assembling station is approximately 1.3 cub. metres of compressed air at 7 kg. for a production of 72 finished moulds per hour (50 seconds per mould). The compressed air required for three small pneumatic nozzles, working for 20 min. per hour, has also to be provided.

Sand Preparation.

All the sand from the moulding boxes knocked out over the grating (38) has to be transported to the sand plant and prepared before returning to the hoppers (25 and 26) of the machine to permit of its being effectively rammed by rollers. The output of the sand may vary from 10 to 20 cub. metres per hour, according to the dimensions of the moulding boxes used and the flow of production. The sand plant may be laid out to suit the user's convenience and may be located outside the moulding shop (as in the first installation), but it is preferable to have it integral with the machine in order to utilise the ground available inside the conveyor ring, making it very simple as shown in Fig. 1 and as used by the Usines de Rosières.

The used sand falls into a hopper (38) with regulatable bottom, which directs it on to an endless conveyor (39) feeding a rotary riddle (40). The sifted sand is received by the endless conveyor (41), constituting the distributor of the elevator (42), which empties it on to a rotatory table (43) forming the mill. It then falls into a revivifier (44), which discharges it, prepared and aerated, on to an endless conveyor (45) which feeds the hoppers (25 and 26) of the machine. The supplies of new sand are effected by means of the hopper with regulatable bottom (46), which empties it directly on to the conveyor (39). All the mechanism of this sand plant is driven by a single 21-h.p. motor.

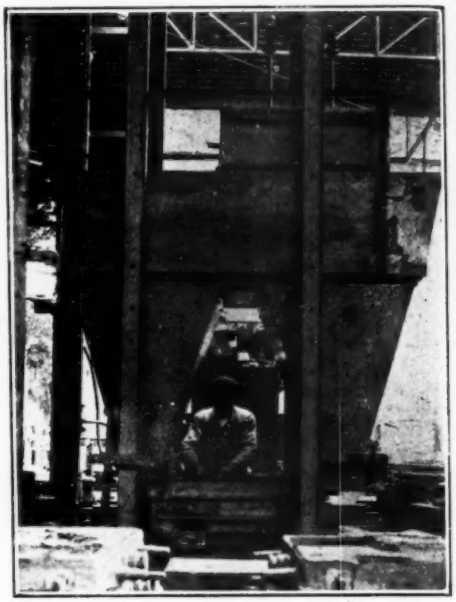


Fig. 6.—Continuous Moulding Machine, Type RB1.

Tucking the sand by hand under the box bars between two sand shutes.

Labour.

For the normal manufacture of heating-apparatus castings the necessary staff consists of:—2 strippers (A and B); 1 man to remove the castings and runners (C); 2 men for tucking the sand under the moulding-box bars (D and E) (one man is enough if the boxes used are only about 400 mm. in length); 1 supplementary moulder (F); 1 man for removing the moulds with the automatic tackle (G); 1 assembler (H); 1 man for cleaning and dusting powder over the pattern plates; 2 casters (I and K) (if the surface of the castings is such as to require three or four ladles for filling the mould, the number of casters would, of course,

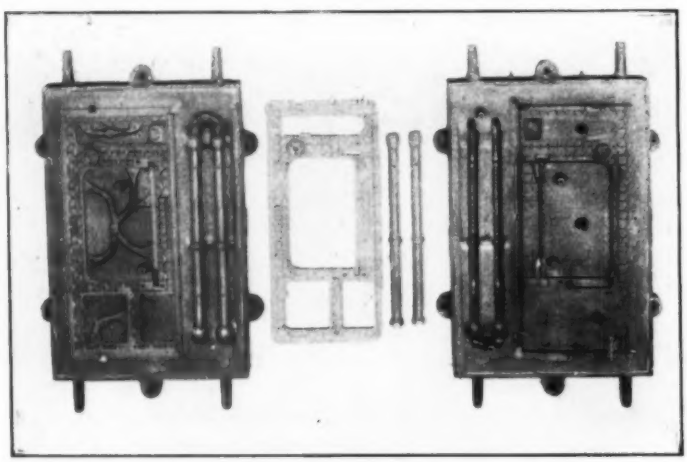


Fig. 7.—Kitchen Range Parts—Castings and Patterns.

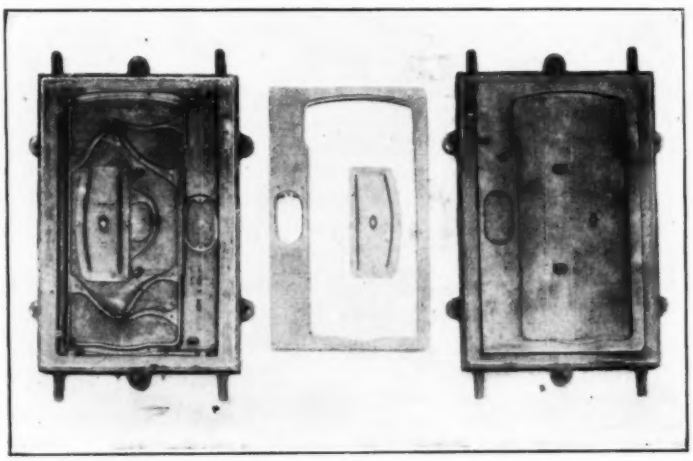


Fig. 8.—Top and Cover of Boiler for Kitchen Range—Patterns and Castings.

have to be increased to 3 or 4, but, in any case, 4 casters are sufficient for pouring the moulds produced by two continuous moulding machines installed beside one another); 1 man for working the sand plant (L). A foreman is also required, but he can supervise two adjacent shops simultaneously.

Production and Wages.

Most of the patterns used at present on the Rosières-Bachon continuous moulding machines were in existence before the machines were produced and were used for moulding on hydraulic machines of various capacities, corresponding to 12 series of moulding boxes classified according to their dimensions. It was, therefore, necessary to fix production times corresponding to these series of boxes and also to give the men 6 minutes' rest per hour, as they are, in fact, working strenuously all the time, and it was estimated that the average of spoiled castings from all causes would be 10 per cent. The number of good castings which the machine would produce per hour having thus been determined, a piecework rate, based upon the standard hourly wage which the men were to earn, was fixed per 100 castings passed as good after knocking out for each class of moulding box.

The aggregate wage value produced each day in the shop and divided by the number of operators represents the payment earned per head. Wages are therefore identical for all the workmen except the foreman, who receives a supplementary bonus. There has never been the slightest complaint on this subject. Moreover, the workmen are at liberty to change positions among themselves every hour if they wish, but they hardly ever do so.

The following production speeds had been estimated for a complete mould composed of two boxes (top and bottom): 50, 55, 60, 65 and 70 sec. When the team had become accustomed to the work the wages earned by them exceeded all expectations for the following reasons: (1) The scrap, for which 10 per cent. had been estimated, never exceeded 5 per cent.; (2) the crew increased the speed of production all round. The complete mould in a box 700 × 500 mm., for which 50 sec. had been estimated, was finished in 42 sec., while all the others were finished in 5 sec. less than had been estimated. With a box 40 in. × 80 in. × 4 in. one complete mould per min. is produced normally.

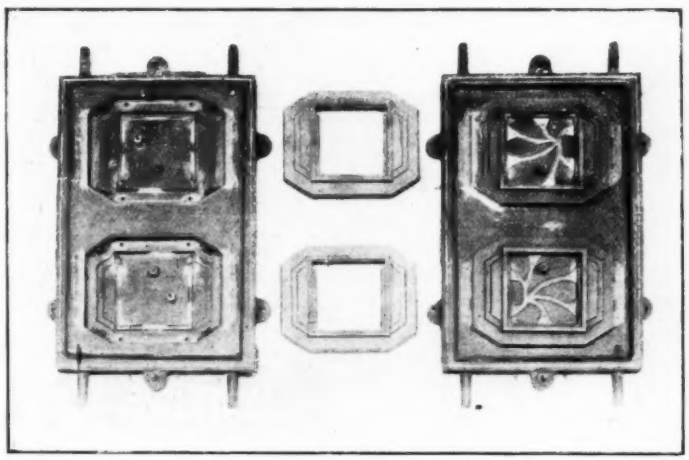


FIG. 9.—TOP OF WOOD-FIRED STOVE—PATTERNS AND CASTINGS.

Advantages.

(1) The whole plant constitutes a complete high-capacity moulding shop in a very limited space, so that there is a great economy in area and therefore in building.

(2) The apprenticeship of the workmen engaged on the machine is completed in a few hours, as each of them has to perform only a small number of well-defined movements. Their rate of work is governed by the machine.

(3) The number of moulding boxes is relatively small, as they are all utilised uninterruptedly in the circuit; they pass continuously from the moulding circuit to the conveyor and from the conveyor to the moulding circuit. It may be mentioned that only 30 complete moulding boxes in each series are used in the course of manufacture for an unlimited production, whereas 150 were required in the hydraulic machine shops.

(4) The scrap is extremely low.

(5) The supervision of the shop is very easy.

(6) The motive power required for the whole plant is insignificant (4 h.p. for the machine and its conveyor for the finished moulds).

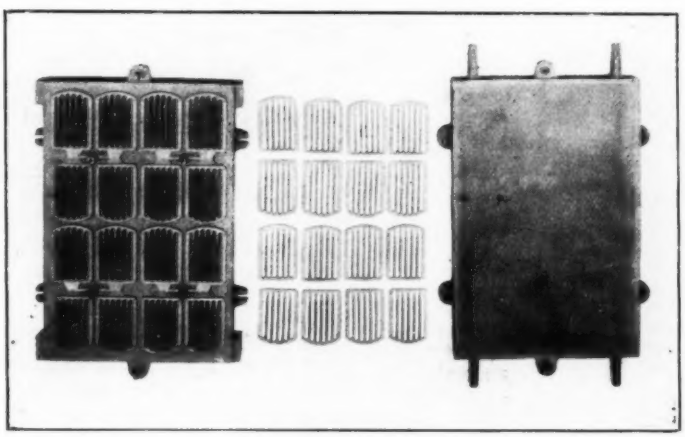


FIG. 10.—GRATES FOR COAL-FIRED COPPERS—PATTERNS AND CASTINGS.

Evaluation of Raw Materials for the Iron and Steel Industry.

A Paper by HERR ALFONS WAGNER, of Völklingen (Saar), in a recent issue of "Stahl und Eisen," deals with the subject of judging the suitability of raw materials for the iron and steel industry and the results of research work in connection therewith, are published as a report of the Blast-Furnace Committee of the Association of German Ironmasters. A general outline is given of the present state of knowledge regarding the known, but principally the less-known, properties of the most important raw materials, viz., coal, coke and ore, as well as pig-iron, and the writer explains the reasons for the lack of a sure method of judging these materials for particular purposes and the need for further research in this field. The evaluation of coal in respect of its suitability for coal-dust firing is relatively simple. With the exception of coals possessing certain specific properties, all kinds of coal can be burned advantageously in coal-dust furnaces. The relationship between the chemical composition and the coking capacity of coal is much more complicated. Notwithstanding the extensive research work and noteworthy achievements even of the last few years nothing really precise on this subject can yet be stated. The very great differences in the properties of coal do not merely affect the appearance and physical structure of the coke produced from it, but also its behaviour in smelting. The various laboratory methods for the technical valuation of coke nearly all have the drawback of requiring the samples to be powdered or crushed very small, so that the influence of the surface escapes observation. The best test of the suitability of coke is that actually carried out in the blast furnace or cupola. The laboratory tests for the technical valuation of ore also disregard its physical properties, although these, in conjunction with the chemical composition, are of decisive importance. In judging the quality of pig-iron the chemical composition is an inadequate guide. By taking into consideration the conditions under which the iron is produced in the blast furnace and its chemical analysis, it is no doubt possible to judge pig-iron in respect of its hardening and softening properties, but such a valuation requires very great experience and in any case does not hold good in every case. In the case of basic pig-iron, too little consideration has hitherto been paid to certain relations between composition and capacity to be turned into steel in the converter. Herr Wagner considers that in order to arrive at a satisfactory method for the technical valuation of raw materials co-operation between the practical man and the scientist is absolutely necessary.

Reports and Dividends.

Davy Brothers, Limited.—Profit, £2,837, reducing the debit balance to be carried forward to £45,772.

W. & T. Avery, Limited.—Credit balance, including amount brought in, £173,810; dividend of 10 per cent. on the ordinary shares, making 15 per cent.; to reserve, £20,000; carried forward, £59,035.

Petters, Limited.—Net profit, £40,917; brought in, £28,535; preference dividends, £11,812; interest on funding certificates, £1,499; to funding certificate redemption fund, £1,000; dividend on the ordinary shares of 7 per cent., £6,103; to reserve, £10,000; carried forward, £39,037.

The Economic Utilisation of British Pig-Iron Resources.

(*Continued from page* 10.)

District "A"—Scotland.

Col. 3. H=Hot, C=Cold, W=Warm, R=Refined. Where firm has not made statement as to this, unless authors know for certain that it is as shown, this is enclosed in ( ).
Col. 5. A=Usual AVERAGE Analysis, BOLD BLACK Type. R=Usual RANGE of Analysis, Smaller Lighter Type. A–R part average, part range, in respective types as above.

Index No.	Firm or Works.	Type.	Designation, Grade or Brand.		COMPOSITION. C. Combd.	C. Gr.	C. Total.	Si.	S.	P.	Mn.	Other Constituents.	Remarks.
1	WM. BAIRD & CO., COATBRIDGE, 168, West George Street, GLASGOW.	(H)	GARTSHERRIE No. 1 ..	A	**0·25**	**3·25**	**3·50**	**3·00**	**0·025**	**0·60**	**1·10**	Fe **91·775**	—
			,, ,, ..	R	0·22—0·28	3·20—3·40	—	2·80—3·20	0·020—0·030	0·2—0·8	0·8—1·25	—	—
		(H)	,, No. 3 ..	A	**0·30**	**3·00**	**3·30**	**2·50**	**0·040**	**0·60**	**1·10**	,, **92·460**	—
			,, ,, ..	R	0·28—0·35	2·90—3·15	—	2·0—2·75	0·030—0·050	0·2—0·8	0·8—1·25	—	—
		(H)	,, No. 4 ..	A	**0·50**	**2·70**	**3·20**	**1·50**	**0·085**	**0·60**	**1·10**	,, **93·515**	—
			,, ,, ..	R	0·45—0·60	2·50—2·80	—	1·0—1·80	0·075—0·10	0·50—0·70	1·00—1·25	—	—
		(H)	,, Hematite ..	A	**0·25**	**3·20**	**3·45**	**2·50**	**0·040**	**0·045**	**1·50**	,, **92·465**	—
			,, ,, ..	R	0·25—0·35	3·0—3·30	—	2·0—2·80	0·030—0·050	0·040—0·050	1·30—1·70	—	—
		(H)	EGLINGTON No. 1	A	**0·25**	**3·30**	**3·55**	**3·00**	**0·025**	**0·65**	**1·05**	,, **91·725**	—
			,, ,, ...	R	0·25—0·30	3·2—3·45	—	2·75—3·25	0·020—0·035	0·50—0·70	1·0—1·20	—	—
		(H)	,, No. 3	A	**0·35**	**2·90**	**3·25**	**2·50**	**0·045**	**0·65**	**1·05**	,, **92·505**	—
			,, ,, ...	R	0·26—0·35	2·90—3·20	—	2·30—2·70	0·030—0·050	0·50—0·70	1·0—1·20	—	—
		(H)	,, No. 4	A	**0·50**	**2·65**	**3·15**	**1·50**	**0·090**	**0·65**	**1·05**	,, **93·560**	—
			,, ,, ...	R	0·40—0·60	2·50—2·70	—	1·40—1·90	0·07—0·10	0·60—0·70	1·00—1·20	—	—
		(H)	,, Hematite ..	A	**0·25**	**3·30**	**3·55**	**2·90**	**0·035**	**0·045**	**1·65**	,, **91·810**	—
			,, ,, ..	R	0·25—0·35	2·90—3·35	—	2·70—3·00	0·035—0·050	0·045—0·050	1·50—1·80	—	—
2	CARRON CO., FALKIRK	H	SOFT, Class H, No. 3 ..	A	**0·2**	**3·4**	**3·6**	**3·0**	**0·025**	**1·25**	**0·7**	,, **91·425**	—
			,, ,,	R	—	—	—	2·25—3·5	0·01—0·04	—	—	—	—
		H	SOFT, Class M, No. 3.. ..	A	**0·2**	**3·4**	**3·6**	**2·75**	**0·03**	**0·5**	**1·2**	,, **91·92**	—
			,, ,,	R	—	—	—	2·25—3·5	0·01—0·04	—	—	—	—
		H	CYLINDER, Class L.. ..	A	**0·4**	**3·1**	**3·5**	**1·25**	**0·06**	**0·25**	**1·00**	,, **93·94**	—
			,, ,,	R	—	—	—	1·0—1·5	0·05—0·08	—	—	—	—
3	COLTNESS..		.. ..	—	—	—	—	—	—	—	—	—	"Blast furnaces out of commission last five years; not now makers."
4	D. COLVILLE & SONS, GLASGOW.	H	"DALZELL" No. 1, soft, rich	A	**0·28**	**3·5**	**3·78**	**3·35**	**0·03**	**0·30**	**1·15**	Arsenic, chromium, nickel, copper, etc., traces	Manufactured in coal-fed furnaces.
			,, ,,	R	0·20—0·40	3·4—3·6	3·7—3·9	3·0—3·75	0·01—0·03	Max. 0·35	0·8—1·20		
		H	,, No. 2	A	**0·30**	**3·55**	**3·85**	**3·15**	**0·03**	**0·30**	**1·10**		
			,, ,,	R	0·20—0·45	3·35—3·60	3·70—3·90	2·5—3·25	0·01—0·03	Max. 0·35	0·8—1·20		
		H	,, No. 3	A	**0·35**	**3·50**	**3·85**	**2·75**	**0·035**	**0·30**	**1·05**		
			,, ,,	R	0·35—0·50	3·20—3·60	3·65—3·95	2·25—3·25	0·02—0·05	Max. 0·35	0·8—1·2		
		H	,, Hard 3 or half bar	A	**0·38**	**3·32**	**3·70**	**2·25**	**0·05**	**0·30**	**0·90**		
			,,	R	0·35—0·50	3·25—3·40	3·65—3·85	2·0—3·0	0·02—0·06	Max. 0·35	0·8—1·2		
		H	,, Rosy 4 ..	A	**0·48**	**3·27**	**3·75**	**1·85**	**0·07**	**0·30**	**0·90**		
			,, ,,	R	0·40—0·65	3·0—3·35	3·60—3·85	1·50—2·0	0·05—0·07	Max. 0·35	0·6—1·0		
		H	,, No. 4 (close) ..	A	**0·65**	**3·00**	**3·65**	**1·40**	**0·09**	**0·30**	**0·80**		
			,, ,,	R	0·50—0·75	2·90—3·20	3·60—3·75	1·0—2·0	0·05—0·10	Max. 0·35	0·6—1·0		
		R	,, Special refined	R	—	—		0·8 to 1·0					
		R	,, ,,	R	—	—		1·0 ,, 1·2					
		R	,, ,,	R	—	—	Under	1·2 ,, 1·4					
		R	,, ,,	R	—	—	3·0	1·4 ,, 1·6	Under	Under	0·60—1·0	—	"Graded according to silicon content."
		R	,, * ,,	R	—	—	*	1·6 ,, 1·8	0·05	0·25			
		R	,, ,,	R	—	—		1·8 ,, 2·0					
		R	,, ,,	R	—	—		Over 2·0					
		R	LOW SULPHUR, White Iron	R	—	—	Under 3·0	0·4 to 0·6	Under 0·04	Under 0·20	0·8—1·0	—	"Base for the manufacture of chilled castings." See their pamphlet for mechanical tests.

* Often less than 2·8 per cent., and a maximum of 3 per cent. total carbon is guaranteed.

District "A"—Scotland—*continued.*

Iron

pamphlet for mechanical tests.

* Often less than 2·8 per cent., and a maximum of 3 per cent. total carbon is guaranteed.

District "A"—Scotland—*continued.*

Index No.	Firm or Works.	Type.	Designation, Grade or Brand.		COMPOSITION. C. Combd.	C. Gr.	C. Total.	Si.	S.	P.	Mn.	Other Constituents.	Remarks.
5	W. DIXON, LTD., GLASGOW.	H	GOVAN Nos. 1 and 3	A	**0·84**	**2·96**	**3·80**	**3·49**	**0·031**	**0·526**	**1·260**	Fe **90·893**	—
			,, ,, ...	R	0·72—0·99	2·66—3·31	3·51—4·11	2·58—4·61	0·024—0·042	0·492—0·544	1·01—1·51	—	—
		H	CALDER Nos. 1 and 3	A	**0·73**	**2·67**	**3·40**	**3·17**	**0·031**	**0·56**	**1·460**	,, **91·379**	—
			,, ,, ...	R	0·63—0·91	2·37—2·94	3·24—3·57	2·50—4·13	0·026—0·040	0·372—0·807	1·08—1·80	—	—
		H	HEMATITE Nos. 1 and 3 ..	A	**0·80**	**2·71**	**3·51**	**2·77**	**0·023**	**0·044**	**1·85**	,, **91·803**	—
			,, ,, ...	R	0·42—1·01	2·33—3·35	2·62—4·29	1·97—3·76	0·010—0·038	0·041—0·046	1·09—3·38	Arsenic 0·028—0·120 Copper 0·011—0·076 Chromium 0·025—0·28 Aluminium 0·010—0·035	—
		H	Special LOW PHOS. Hematite..	A	**1·17**	**2·66**	**3·83**	**2·24**	**0·024**	**0·027**	**1·150**	Fe **92·729**	—
			,, ,, ,, ,, ..	R	1·04—1·31	2·46—2·82	3·50—4·00	1·97—2·50	0·020—0·032	0·024—0·030	0·86—1·37	—	—
		H	FERRO-SILICON	A	**0·74**	**2·84**	**3·58**	**13·02**	**0·025**	**0·071**	**2·90**	,, **80·404**	—
			,, ,, ...	R	0·60—0·88	2·77—2·94	3·41—3·70	11·28—14·62	0·015—0·022	0·054—0·086	1·51—5·04	—	—
6	JAMES DUNLOP & CO., LTD., TOLCROSS ..	(H)	CLYDE No. 1	A	**0·35**	**3·25**	**3·60**	**2·60**	**0·03**	**0·40**	**1·00**	,, **92·39**	—
		(H)	,, ,, 3	A	**0·60**	**2·75**	**3·35**	**2·25**	**0·05**	**0·40**	**1·00**	,, **92·95**	—
		(H)	,, ,, 4	A	**0·70**	**2·50**	**3·20**	**1·80**	**0·06**	**0·40**	**0·90**	,, **93·64**	—
7	GLASGOW IRON & STEEL CO., LTD., GLASGOW & WISHAW.	(H)	WISHAW Special Hematite ..	A	**0·2**	**3·25**	**(3·45)**	**2·5**	**0·02**	**0·028**	**1·10**	(diff.) ,, **92·902**	Max. P and S (each) 0·03.
			,, ,, ..	A	**0·2**	**3·25**	**(3·45)**	**2·6**	**0·03**	**0·033**	**1·00**	,, **92·887**	Max. P and S (each) 0·035.
			,, ,, ..	R	—	—	—	2·0—4·0	—	—	—	—	Silicon can be supplied to range shown.
		(H)	WISHAW Ordinary Hematite Mixed Nos. ..	A	**0·2**	**3·25**	**(3·45)**	**2·75**	**0·030**	**0·048**	**1·25**	,, **92·472**	Silicon can be supplied to range shown.
				R	—	—	—	2·0—5·0	—	—	—	—	
		(H)	WISHAW Foundry Iron No. 1..	A	**0·25**	**3·25**	**(3·50)**	**3·25**	**0·02**	**0·50**	**1·05**	,, **91·68**	—
			,, ,, ..	R	0·2—0·3	3·0—3·3	(3·2—3·6)	2·75—3·50	0·01—0·03	0·40—0·60	0·90—1·20	—	—
		(H)	WISHAW Foundry Iron No. 3..	A	**0·35**	**3·10**	**(3·45)**	**2·75**	**0·03**	**0·50**	**1·05**	,, **92·22**	—
			,, ,, ..	R	0·25—0·4	2·9—3·15	(3·15—3·55)	2·5—3·25	0·015—0·05	0·40—0·60	0·90—1·20	—	—
		(H)	WISHAW Foundry Iron No. 4..	A	**0·55**	**2·70**	**(3·25)**	**1·85**	**0·065**	**0·50**	**1·05**	,, **93·285**	—
			,, ,, ..	R	0·45—0·65	2·6—2·9	(3·05—3·55)	1·25—2·25	0·04—0·09	0·40—0·60	0·90—1·20	—	—
8	LANGLOAN IRON & CHEM. CO., LTD., COATBRIDGE.	—			"As works now standing do not think any useful purpose served in sending figures which may not represent what we make when we resume working."								No stock.
9	MERRY & CUNINGHAME, GLASGOW.	—			No reply. None shown as working September 30 or December 31, 1929.								No reply.
10	SHOTTS IRON CO.,* LTD., EDINBURGH, &c.	(H)	SHOTTS No. 1	A	**0·25**	**3·55**	**3·80**	**3·25**	**0·02**	**0·50**	**1·20**	—	*A few selected extracts from remarks.* "Rich and soft, capable of carrying a large proportion of scrap in the cupola charge; devoid of chilling tendencies . . . suitable for all classes of light castings. . . ."
			,, ,, ...	R	0·15—0·35	3·4—3·7	—	2·75—3·75	0·01—0·03	0·30—0·70	0·7—1·3	—	
		(H)	,, No. 3 Soft	A	**0·30**	**3·45**	**3·75**	**2·80**	**0·02**	**0·50**	**1·15**	—	"Similar. Suitable for castings of medium thicknesses, and gives soft tough machining qualities."
			,, ,, ,, ...	R	0·20—0·45	3·3—3·6	—	2·25—3·5	0·02—0·03	0·30—0·70	0·7—1·3	—	
		(H)	,, No. 3 Medium ..	A	**0·37**	**3·35**	**3·72**	**2·40**	**0·03**	**0·50**	**1·10**	—	"Fairly strong; similar to No. 3 soft . . . suitable for medium and easily machined engineering castings."
			,, ,, ,, ...	R	0·25—0·50	3·2—3·6	—	2·0—3·0	0·02—0·04	0·30—0·70	0·6—1·3	—	

* *Re* Grades No. 1 to Low Phos., makers say: "To ensure consistency in supplies, Shotts iron is stacked to analysis." "Silicon . . . can usually be adjusted within limits to suit buyer's requirements. With a tolerance of 0·20 per cent. on either side of the stated figure we can generally meet their wishes." Total carbon, phosphorus and sulphur are capable also of some adjustment.

District "A"—Scotland—*continued.*

Index No.	Firm or Works.	Type.	Designation, Grade or Brand.		COMPOSITION. C. Combd.	C. Gr.	C. Total.	Si.	S.	P.	Mn.	Other Constituents.	Remarks.
10	SHOTTS IRON CO.,* LTD., EDINBURGH, &c.—*continued.*	(H)	SHOTTS No. 3 Hard	A	0·45	3·20	3·65	2·10	0·04	0·50	1·00	—	"Suitable for castings required to withstand pressure . . . steam and locomotive cylinders, hydraulic work."
			,, ,, ,, ...	R	0·30—0·55	3·1—3·4	—	1·75—2·50	0·03—0·06	0·30—0·70	0·6—1·2	—	
		(H)	,, No. 4 Soft (Rosey Four)	A	0·45	3·15	3·60	1·70	0·06	0·50	0·95	—	"Strong close-grained . . . . suitable for resistance to wear."
			,, ,, ,, ,,	R	0·40—0·65	2·9—3·2	—	1·40—2·00	0·04—0·07	0·30—0·70	0·6—1·1	—	
		(H)	,, No. 4 Hard	A	0·63	2·85	3·48	1·35	0·08	0·50	0·85	—	"Very strong uniformly close-grained . . . suitable for heavy castings, easy to machine; possesses great wear-resisting qualities."
			,, ,, ,, ...	R	0·50—0·75	2·7—3·0	—	0·80—2·0	0·05—0·10	0·30—0·70	0·6—1·0	—	
		(H)	,, Cylinder	A	0·67	2·65	3·32	1·50	0·09	0·40	0·85	—	"Low total carbon. Exceptionally strong and close-grained, suitable for all heavy cylinder castings and other work where extreme strength and toughness necessary."
			,, ,, ...	R	0·50—0·75	2·5—2·75	—	0·80—1·60	0·07—0·10	0·30—0·70	0·7—1·1	—	
		(H)	,, High Duty	A	0·68	2·90	3·58	1·60	0·07	0·35	1·45	—	"Useful when high resistance to wear required or where steel additions are made to cupola charge. Efficiency in productions of heat-resisting castings, Diesel cylinders, linings, pistons, &c."
			,, ,, ...	R	0·40—0·75	2·6—3·2	—	1·00—2·50	0·03—0·10	0·30—0·50	1·0—1·75	—	
		(H)	,, Low Phosphorus ..	A	0·45	3·30	3·75	2·50	0·03	0·14	0·85	—	"Suitable where extreme strength and heat-resisting qualities necessary."
			,, ,, ,, ..	R	0·35—0·75	2·8—3·3	—	1·60—3·50	0·02—0·10	0·10—0·25	0·6—1·2	—	
		(H)	,, Mottled	A	1·50	2·00	3·50	0·90	0·15†	0·50	0·70	—	†"Can be supplied with S below 0·06 per cent."
			,, ,, ...	R	1·1—1·7	1·6—2·4	—	0·60—1·20	0·05—0·18	0·30—0·70	0·4—0·8	—	
		(H)	,, White	A	2·80	0·50	3·30	0·50	0·25	0·50	0·60	—	"Suitable for chilled and malleable castings."
			,, ,, ...	R	2·5—3·0	0·4—0·6	—	0·30—1·00	0·20—0·30	0·30—0·70	0·4—0·75	—	
		(H)	,, Basic	A	0·80	3·10	3·90	1·00	0·04	0·75	1·60	—	See second note below *re* basic.
			,, ,, ...	R	0·6—1·2	2·9—3·7	3·6—4·4	0·5—1·25	0·02—0·06	0·60—0·90	1·5—2·0	—	
11	SUMMERLEE IRON CO., LTD., COATBRIDGE.	(H)	"SUMMERLEE" No. 1 ..	A	0·16	3·34	(3·50)	3·00	0·02	0·70	1·25	—	All are "Representative Analyses."
		(H)	,, No. 2 ..	A	0·20	3·30	(3·50)	3·50	0·02	0·70	1·25	—	
		(H)	,, No. 3 ..	A	0·25	3·20	(3·45)	2·50	0·025	0·70	1·25	—	
		(H)	,, No. 4 ..	A	0·25	3·00	(3·25)	2·00	0·06	0·70	1·25	—	
		(H)	,, Mottled ..	A	1·67	1·80	(3·47)	1·26	0·13	0·70	1·25	—	
		(H)	,, White ..	A	0·59	3·00	(3·59)	0·52	0·15	0·70	1·25	—	
		(H)	,, Basic ..	A	0·25	3·00	(3·25)	1·25	0·06	0·70	1·25	—	
		(H)	,, Special Foundry ..	A	0·25	3·25	(3·50)	2·50	0·03	0·40	1·25	—	
		(H)	,, Hematite ..	A	0·25	3·35	(3·60)	2·25	0·05	0·05	1·50	—	
		(H)	,, Special Hematite ..	A	0·25	3·35	(3·60)	2·25	0·03	0·03	1·50	—	
		(H)	,, ,, (lower S and P)	A	0·25	3·35	(3·60)	2·25	0·025	0·025	1·50	—	
12	MUIRHEAD, WM., & CO., Shettleston, GLASGOW.	—	REFINED IRON	A	No reply received.								
			,, ,, ...	R									

* *Re* Grades Nos. 1 to Low Phos., makers say: "To ensure consistency in supplies, Shotts iron is stacked to analysis." "Silicon . . . can usually be adjusted within limits to suit buyer's requirements. With a tolerance of 0·20 per cent. on either side of the stated figure we can generally meet their wishes." Total carbon, phosphorus and sulphur are capable also of some adjustment.

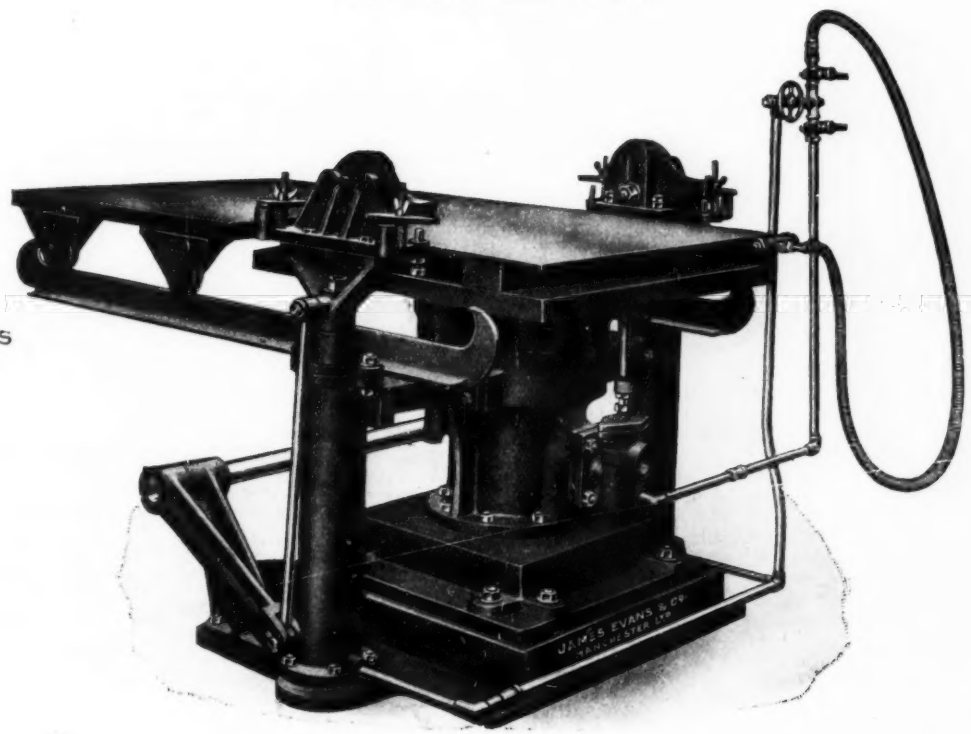
TYPE "C"

JAR RAM MOULDING MACHINE

with Turnover Pattern Plate.

For Pneumatic Power.

TWO MACHINES IN ONE.



UNSKILLED LABOUR ONLY REQUIRED.

The above machine illustrates a Jar Ram Machine with Turnover Pattern Plate which can also be used for Stripping Plate Work.

The machine has been designed to combine the two distinct features above mentioned, and is practically two machines in one, equally suitable for steel, iron, etc.

The machine as illustrated is arranged for work that requires turning over, such as steel moulding. And while the turnover arrangements are intended for general repetition work, by detaching the turnover plate from the trunnion brackets the machine can be used for stripping plate work by attaching the stripping plate to the trunnion brackets. Or, on the other hand, by removing the trunnion brackets as well, the table can be used for jolting general jobbing work.

A very important feature of the machine is the simplicity with which the intensity of the Jolt can be regulated when the operator has become accustomed to the use of the machine, which takes but an hour or so. The valves all being on the exterior of the machine are easily accessible, and there is an adjustable arrangement that will allow the jolt to be varied between 1½ in. to below ¼ in. This being done without disturbing any part of the machine.

The machine is supplied with Withdrawal Carriage, Vibrator, and Blow-off Nozzle complete. It is substantially constructed to stand heavy wear and tear, and requires a minimum amount of skill to operate.

Another important feature of the machine is in the arrangement of the hard wood anvil block for receiving the shock. The blocks being carried well down the machine in a specially designed annular chamber give considerable relief to the foundations. It also provides against the possibility of fracturing the jolting table. Pitch pine blocks are also inserted between the foundation plate and the machine bedplate to assist in the relief on the foundations, and these features considerably improve the working advantages of the machine.

IT IS ALSO ENTIRELY OF BRITISH DESIGN AND MANUFACTURE.

JAMES EVANS & CO. (M/c) LTD.

Britannia Works, BLACKFRIARS, MANCHESTER.

* *Re* Grades Nos. 1 to Low Phos., makers say: "To ensure consistency in supplies, Shotts iron is stacked to analysis." "Silicon . . . can usually be adjusted within limits to suit buyer's requirements. With a tolerance of 0·20 per cent. on either side of the stated figure we can generally meet their wishes." Total carbon, phosphorus and sulphur are capable also of some adjustment.

Melting Difficulties with Small Quantities of Special Iron.

By "Ecossais."

Amongst the many castings required in an engineering works are those used in the manufacture of press tools and consisting of punch holders, bolsters, slabs and bars. The metal for these must be close-grained and reasonably free from blow and shrink holes, these often making it difficult to drill the necessary holes accurately and to correct position. Most foundrymen are aware of the difficulty of producing castings with a uniform grain size throughout, and in addition to using special irons, often apply chills to equalise the rate of solidification of the thicker sections in order to overcome the segregation and consequent open grain probable with varying sections.

The type of metal should be of such a composition as will give a relatively short range of solidification, and a typical analysis would be T.C., 3.2; Si, from 1.2 to 1.5, depending on thickness; Mn, about 0.75; P, about 0.35; and S, about 0.1 per cent., this being poured as hot as possible, preferably about 1,350 to 1,400 deg. C.

Effect of Steel Additions.

As with such a composition castings are liable to come out hard at the corners if cast green, it is advisable to dry all moulds. Even so, castings about 1 in. thick often show up hard on machining, so that, if possible—and if the quantities justify such steps—the castings should be graded according to the thickness and the silicon altered accordingly. The belief that merely to add steel to the mixture will give castings having a uniform grain size, often held by people with no metallurgical knowledge, only shows ignorance on their part of the principles involved. The chief value of adding steel lies in its diluting effect on the cast iron by reducing the percentage of silicon and phosphorus, and under certain conditions in the cupola, the carbon percentage. If left in the cupola too long, there is the risk of contamination by the succeeding charges, which may be of a type intended for lighter-sectioned castings and containing higher percentages of silicon, phosphorus and carbon. In addition, the type of coke and the length of time the iron remains in contact with the coke will make a material difference to the total carbon content of the resultant metal. If the correct metal is obtained, even in the molten state, delay in casting, resulting in dull metal, will produce inferior results and great variation in grain size.

Hard Corners.

It is not unusual with low silicon and steel mixtures to find on castings with square corners of relatively light section that the quick cooling produces solidification at such points before any of the carbon has had time to separate out as graphite. Such places are too hard to machine by ordinary methods, and the fracture shows up white backing-off to mottled and finally to grey. The writer has often heard this appearance described, even by foundrymen, as being due to improper mixture of the steel and the iron, and this again shows lack of knowledge on the subject. Once the steel has been reduced to the molten state in a cupola, it has lost its identity as steel, even if melted alone, owing to the quantity of carbon it will pick up from the coke. Although the fracture is quite white and not machinable at such parts of the casting, due to the carbon being in the combined form instead of separating out as graphite, it will be found on annealing that the fracture is changed to grey and that the parts referred to can be readily machined.

Effecting Separation.

The foundry producing castings $\frac{1}{4}$ in. thick and less, and which require to be drilled and milled, is at a disadvantage compared with, say, a foundry producing machine-tool castings, especially if only small quantities of castings in low-silicon iron are required from day to day. The silicon in the former may run about 2.6 per cent., and could be much higher in the absence of relatively heavy lugs and bosses, which would show drawn places if the silicon rose very much above this figure. If only one furnace is used for both types of metal, the silicon aimed at being under 1.5 per cent. in the latter case, and not more than about 1,000 lbs. of this metal are required every few days for heads, gates and castings, the difficulty will be to prevent contamination and still work economically.

The safest method would appear to be to run off the softer grade containing 2.6 silicon, and blow down, then charging the harder grade containing 1.5 silicon. If, however, there is another grade of special alloy to follow daily, and this must also be preceded by a blow-down, it will be realised that the furnace lining is being put to a severe test. Even with this method, trials will often show that, even after blowing down the soft iron, the harder iron, in such small quantity, often picks up sufficient silicon and phosphorus, probably from metal in small quantities left adhering to coke and lining, as to raise the composition from 1.5 to 1.7 per cent. silicon, with corresponding increase in phosphorus content. The whole of the low-silicon metal may even be collected in a clean ladle, although if this amounted to, say, 3 tons, what may be described as the washing out of the furnace, would show a much smaller increase in silicon and phosphorus on the larger bulk.

Auxiliary Furnaces.

It would appear to be a case where a baby cupola or cupolette could be usefully used, or even a coke-fired tilting furnace, if the bulk of the castings are round about 100 lbs. in weight. The best results appear to be obtained by charging at the commencement of the day's blow and following with a very liberal charge of coke, the metal being drawn frequently at short intervals to a measured height in the ladle, and to avoid having, say, 500 lbs. in the hearth when, maybe, a balance of only 200 lbs. of low silicon remains, the other 3 cwts. being from the charges following, and, therefore, of higher silicon content. Rather than this, the aim should be to get slag at the tap hole with only 900 lbs. of the 1,000 lbs. drawn off, the next 500 lbs. being put into castings of lesser importance, but certainly not into the castings having a thickness of only $\frac{1}{8}$ in., as in such case trouble would just as certainly be encountered when the castings were being drilled or milled. If no suitable moulds are available for this clearing or wash metal, as it may be termed, it must be poured down on the pig bed. Although in most foundries it would be considered better to run the hard iron last, the writer has never experienced any detrimental effect on the soft iron from the above procedure.

There would appear to be a lack of appreciation of the difficulties which a founder may thus have to contend with, and also a failure to realise that it is just as difficult for a founder to produce a small quantity of tool iron, when the bulk of the metal requirements are of a softer grade, as it would be to expect a founder engaged on medium and heavy tool or engine castings to produce a small quantity of soft iron for castings $\frac{1}{8}$ in. thick on which drilling and milling operations had to be performed on a mass-production basis.

The Machinist's Attitude.

The engineer or machinist who expects always to get cast iron uniform throughout, without regard to change of section or variation in thickness of different castings, is probably basing his expectations on his experience with steel forgings. He should consider the work that has been done on the steel before it is reduced to the form of the bar or billet from which the forgings are made, and also the amount of head with accompanying pipe or shrinkage cavity that has been cut from the original ingot. Or, better still, it may be worth his time and trouble to take some obviously sound forgings and have these melted in a crucible furnace for preference, to avoid the question of contamination, and poured into a mould as ordinarily made for cast iron. He would find even with very large feeding heads, which he often considers objectionable with cast-iron castings, that the structure of this casting would be much more variable than the forgings started with. To heat up a forging to welding heat and allow it to cool will not produce shrinkage cavities, and the engineer who cannot understand the variations in an iron casting has, without doubt, never had any experience beyond this point.

Nickel Additions Useful.

Recent developments would seem to indicate that the addition of a small amount of nickel to low-silicon irons is effective in reducing the tendency to sponginess, also enabling the silicon to be reduced lower than would be advisable otherwise, without increasing the hardness or making machining more difficult. For example, instead of using 1.5 per cent. silicon, 1 per cent. would be used, and an addition of 1 per cent. nickel made to replace the reduction of silicon. With small cupola melts, however, where the amount of silicon is difficult to control, it might easily be found that, due to silicon being higher than intended, the effect of the nickel will not be beneficial, and may even be detrimental.

The Insert Method.

A method adopted in many cases with varying success is to cast inserts of cast iron, in effect iron cores, these being subsequently machined out, and, if the surface of these has been thoroughly cleaned and given a thin coat of red lead and turpentine, the machined part will show up quite solid and close grained.

There are a few points to watch, however, in adopting such methods, amongst these the following:—(1) Unless the casting has a very heavy section, the inserts may produce chilling, and if such a probability exists, it is advisable to use the soft grade of iron available where such subterfuges are necessary and provide liberal feeding risers; (2) in all cases it is advisable that the inserts be hot when the metal is poured, more especially if the moulds are cast green, to avoid bubbling and consequent possibility of blow-holes through condensation on the inserts of steam generated immediately the metal enters the mould; and (3) whenever possible, bottom pouring should be adopted, and in such a manner that the metal flows direct to the inserts without turbulence. This will heat up the inserts and reduce chilling effects. If carefully arranged, especially with a dry-sand mould, it will be found that, on sawing such a casting through the inserts, very often these will have been fused and be practically invisible as inserts.

As, apart from parts of castings required to be solid for machining, another advantage of cast-iron inserts, especially on standard jobs when standard *iron cores* can be provided, is that rod feeding may be reduced or even eliminated. Although, unless complete fusion has occurred, the metal as such in the inserts will not add to the strength, the resultant casting may be stronger by virtue of the closing up of the grain.

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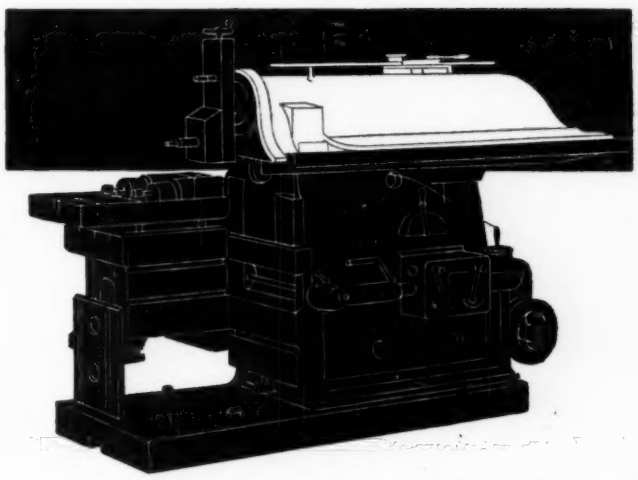
Reduce inertia by reducing deadweight—the power waster. Fast moving parts especially need this consideration. A definite saving in weight, means a corresponding economy in power, reduced bearing stresses and easier handling.



For example the complete head of a shaper should be of Aluminium Alloy.

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JAS. DURRANS & SONS, LIMITED.

PHŒNIX WORKS, PENISTONE, NR. SHEFFIELD.

Trade Talk.

Messrs. R. Y. Pickering & Company, Limited, of Wishaw, have received from the L.N.E.R. a contract for 80 steel wagons, each of 50 tons capacity.

The Newbold Iron Company, Limited, iron, steel and mineral merchants, have removed from King's Court, 115, Colmore Row to Broad Street Chambers, Birmingham.

The Furness Shipbuilding Company, Limited, Haverton Hill-on-Tees, have received an order from Norway for two whale oil factories of a dead-weight tonnage of 21,500 each.

Messrs. Bruce Peebles & Company, Limited, Edinburgh, have taken larger offices at Standard Buildings, Leeds. Mr. Cecil C. Higgens is in charge of the Leeds office as hitherto.

The Coventry Chain Company, Limited, has entered into a provisional agreement with a view to the co-ordination of the interests of the company with those of Hans Renold, Limited.

Messrs. William Boby & Company, Limited, have received a contract from the York Street Flax Spinning Company, Limited, Belfast, for one of their "Simplex" type lime-soda water-softening plants, having an hourly capacity of 12,000 galls.

Messrs. Scott's Shipbuilding & Engineering Company, Limited, Greenock, have received an important contract for an oil tanker of 14,000 tons deadweight for the Standard Fuel Oil Company, of New York. The firm will supply the machinery.

A call of 5s. per share has been made on the preference shares of the Duffield Iron Corporation, Limited. This will make the shares 15s. paid. The company was formed to prove and develop commercially the Duffield processes for reduction of ores.

New depôts have been opened by the Metropolitan-Vickers Electrical Company, Limited, for the sale of their "Cosmos" lamps in Glasgow and Birmingham. The addresses are 177, West George Street, Glasgow, and International Exchange Buildings, Edmund Street, Birmingham.

Messrs. Browett, Lindley & Company, Limited, engineers, Sandon Works, Patricroft, have purchased the patterns, drawings, goodwill and trade name of Messrs. Bumsted & Chandler, Limited, Cannock Chase Engine Works, Hednesford, manufacturers of high-speed engines, pumps, fans, etc.

During his recent visit to the Tees-side the Prince of Wales, accompanied by Sir Hugh Bell, paid a visit of inspection to the iron and steel undertakings of Messrs. Dorman, Long & Company, Limited. The Prince was conducted around the departments by Mr. Arthur Dorman. The works of Synthetic Ammonia & Nitrates, Limited, were also visited.

Messrs. Brown Bayley's Steelworks, Limited, Sheffield, are to instal electrical plant and equipment to take the place of the steam power now employed in rolling alloy and high-carbon steel. The equipment has been ordered from the English Electric Company, Limited. The mill will be driven by a single electric motor having a maximum output of 6,000 b.h.p.

Messrs. Vickers-Armstrongs, Limited, launched on June 26, from their Barrow shipyard, the twin-screw turbine steamer "Mayon," which is being built for Messrs. T. L. Duff & Company, Glasgow, for passenger and cargo service in the Far East. The vessel has a length of 340 ft., and is propelled by two sets of Parsons turbines with single-reduction gearing.

The inspection of the National Physical Laboratory by the General Board took place on Friday, June 27. Visitors were received in the Main Aerodynamics Building by Sir Ernest Rutherford, O.M., President of the Royal Society (chairman of the Board), Sir Richard Glazebrook (chairman of the Executive Committee) and Sir Joseph Petavel (director). Various experiments and apparatus were shown in the different departments.

New proposals were accepted on June 24 on behalf of the 4½ per cent. debenture stockholders of Messrs. Cammell, Laird & Company, Limited, shipbuilders, Birkenhead, for the repayment of the whole of their stock. The original proposals failed to secure the required majority. Instead of being asked to extend the dates for repayment of the whole of their stock for five years from July 1, 1930, they were asked, and have agreed, to extend the date for repayment of one-half only of their stock, the rate of interest being increased from 4½ to 5½ per cent.

The bi-centenary of Messrs. W. & T. Avery, Limited, a preliminary notice of which appeared in our issue of June 19, was celebrated on July 1. Guests were able to visit the Soho Foundry, which has associations with Watt, Boulton and Murdock, and were shown the various types of weighing machines in every stage of production. Speakers at the luncheon included Sir Walter Raine (President of the Association of British Chambers of Commerce), Sir J. Fortescue-Flannery (chairman of the company), Sir Gilbert C. Vyle (managing director) and Mr. George Barnes.

Sir Holberry Mensforth, a director of Messrs. Dorman, Long & Company, Limited, reviewed the position of the iron and steel industry in an address recently to the West Hartlepool Rotary Club on "Some Trade Problems." He said that, despite the difficulties created by war policy, the iron and steel industry was producing at a less increase over pre-war prices than in the case of any other major product. They were faced with railway rates at 60 per cent. more than in 1913, and wages in the industry were higher, but, despite these great handicaps, the price of their products was only 14 per cent. over 1913. That did not suggest inefficiency.

An interesting addition to the Royal United Service Museum, Whitehall, is one of the links of the "mightie chaine of yron" which formed part of the early defences of Portsmounth Harbour. The chain was made to be buoyed up across the mouth of the harbour by means of three barges, and it is mentioned in a Navy Account, presented in February, 1522, as having cost £40. Apparently the chain was not put into use until 1545, and when, about 100 years later, another chain was made, the original one was left in the mud. The President of the Staffordshire Iron and Steel Institute recently suggested recovering some of the links with a view to subjecting them to metallurgical examination. This was done, and one of the links, measuring 3 ft. 8 in. by 14 in., was presented to the Royal United Service Museum. It had been cut necessarily for the purpose of removal, and before its exhibition it was repaired by the Barimar welding specialists.

Government contracts recently placed include the following:—Admiralty: Bolts, naval brass, nuts and studs, I. C. I. Metals, Limited, Birmingham; Thos. Eaves, Limited, Birmingham; chain cable, Woodhouse Bros., Cradley Heath; J. G. Walker & Son, Limited, Old Hill. War Office: Aluminium alloy rods, Vickers-Armstrongs, Limited, Newcastle-upon-Tyne; boiler plant, Babcock & Wilcox, Limited, Renfrew; pig-iron, Barrow Hematite Steel Company, Limited, Barrow-in-Furness; steel castings, W. Beardmore & Company, Limited, Glasgow; A. Baird & Son, Limited, Hamilton; steel plates, Park Gate Iron & Steel Company, Limited, Rotherham. Crown Agents for the Colonies: Bolts and nuts, G. Cooper & Sons, Limited, Sheffield; galvanised sheets, Wolverhampton Corrugated Iron Company, Limited, Ellesmere Port; locomotives, Hunslet Engine Company, Limited, Leeds; Nasmyth, Wilson & Company, Limited, Manchester; pipes, Cochrane & Company, Limited, Middlesbrough; Quirk, Barton & Company, London; Stanton Ironworks Company, Limited, Nottingham; Staveley Coal & Iron Company, Limited, Chesterfield; Scottish Tube Company, Limited, Glasgow; steel poles, British Mannesmann Tube Company, Limited, London, E.C.; steel tanks, F. Braby & Company, Limited; steel tubes, Stewarts & Lloyds, Limited; steelwork, Wm. Bain & Company, Limited, Coatbridge; Braithwaite & Company (Engineers), Limited, London; A. Findlay & Company, Limited, Motherwell; Horsehay Company, Limited; Motherwell Bridge & Engineering Company, Limited, Motherwell; Pearson & Knowles Coal & Iron Company, Limited, Warrington; Tees Side Bridge & Engineering Works, Limited, Middlesbrough.

International Congress of Acetylene, &c., Welding.—The Tenth International Congress of Acetylene, Autogenous Welding and Allied Industries, is being held in Zürich, Switzerland, July 9 to 12, for which co-operation of welding associations from America and 13 European countries has been assured. Meetings for discussion are held in the Federal Polytechnic School, and various industrial establishments in the neighbourhood are being inspected. Headquarters are at the office of the Swiss Acetylene Association, 12 Ochsengasse, Basle, Switzerland.

Personal.

Mr. Basil F. Trask, who has been associated with Messrs. Baxter, Fell & Company, iron and steel merchants, 36, Leadenhall Street, London, E.C.3, for many years, has been admitted to partnership in the firm.

Messrs. C. S. Freeman, C. F. Livermore, C. E. Rogers, and Robert Small have been appointed to the directorate of the Crittall Manufacturing Company, Limited. The new directors are heads of departments in the organisation.

Mr. Harry V. Walker, general manager of the New Cransley Iron & Steel Company, Limited, Kettering, has retired after being associated with the company for the last 38 years. Mr. Walker's successor is Mr. John B. Fortune.

Mr. S. L. Baister, manager of the London & North Eastern Railway Company's locomotive works at Gateshead, has been appointed manager of the Stratford (Great Eastern section) locomotive works in succession to Mr. T. O. Mein, who retired on June 30. Mr. Baister's position at Gateshead will be filled by Mr. G. Caster, assistant works manager at Stratford.

Mr. R. H. Archer Coulson, who has been appointed manager of the Parkhead Forge, belonging to Messrs. William Beardmore & Company, Limited, took up his duties on July 1. Mr. Coulson was formerly with Messrs. Sir B. Samuelson & Company, Newport Ironworks, for 16 years, and for several years was general works manager of the Skinningrove Iron Company. He is a representative on the board of governors of the Constantine Technical College, Middlesbrough, and a past-President of the Cleveland Institution of Engineers.

As a memorial to the late Sir George Beilby, the distinguished chemical engineer, who died in 1924, a fund was collected in 1926 from the interest on which, at the discretion of the administrators, awards are to be made from time to time to British investigators in science, to mark appreciation of distinguished original work carried out over a number of years, preference being given to investigations relating to the special interests of Sir George Beilby, including problems connected with fuel economy, chemical engineering and metallurgy. The administrators of the fund have announced the award of £250 each to Dr. Guy Dunstan Bengough, of the Chemical Research Laboratory, Teddington, and Mr. Ulick Richardson Evans, of Cambridge.

Company Meeting.

General Electric Company, Limited.—The annual meeting of the General Electric Company, Limited, was held recently. Sir Hugo Hirst, Bt. (chairman and managing director), who presided, said that the development of the grid scheme had called for considerable extensions at their switchgear works. Until recently the maximum size of outdoor oil circuit-breakers had a breaking capacity of 1,000,000 k.v.a. at 44,000 volts. They were now engaged in the manufacture of outdoor breakers for the Central England section of the grid scheme having a breaking capacity of 1,500,000 k.v.a. at 132,000 volts. The increase in size and capacity of metal-clad switchgear had also been remarkable. During the past year they had completed units of 750,000 k.v.a. breaking capacity, and were building gear up to 1,500,000 k.v.a. in connection with the grid. Other developments of note related to protective gear for overhead lines at 132,000 volts, line contact circuit-breakers, and high-speed breakers. In transformers the new high-tension works at Witton had completely revolutionised their position. The progress the company had made in this particular field could best be gauged if it was realised that up to a few years ago the maximum size of transformer manufactured by them was for 5,000 k.v.a. only. To-day they were carrying out orders for the grid for 30,000-k.v.a. 130,000-volt transformers, and could undertake the building of transformers up to 75,000 k.v.a. in one unit.

In pursuance of a policy of internal rationalisation, the Stockport works of Messrs. Ruston & Hornsby, Limited, are to be closed. The manufacture previously undertaken at this factory will be transferred to the works at Lincoln and Grantham.

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Iron and Steel Markets.

Pig-Iron.

MIDDLESBROUGH.—The closing down, last week, of another local furnace is a sufficient indication of the prevailing conditions in the Cleveland iron market, the total now in blast numbering only 32, of which it is expected that three more will shortly be laid idle. When it is remembered also that a good proportion of the output goes into consumption at the local steelworks, the extent of actual sales in current markets may be readily explained. Not alone in the home market, but in the export section also, are similar conditions observable, the shipments of pig-iron from Tees ports in June aggregating 97,711 tons, as compared with 145,640 tons in the corresponding period in 1929. Fortunately, foreign imports locally are not a serious menace, but in Scotland, Indian pig-iron is still being imported at cut prices, and even after making small price concessions which are not offered elsewhere, Cleveland ironmasters are unable to sell more than about 5,000 tons a month in the whole of the Scottish area. In the conditions thus briefly outlined, it is hardly necessary to add that prices are maintained at previous levels. Thus, No. 1 Cleveland foundry iron is at 70s. per ton, No. 3 G.M.B. 67s. 6d., No. 4 foundry 66s. 6d., and No. 4 forge 66s. per ton.

During the current week a few sales of East Coast hematite have been effected in South Wales, but generally buyers are not to be tempted by cut prices, and the home demand all round is very weak. As a result, prices are still sagging, small lots of East Coast mixed numbers being offered at 71s. per ton. For larger quantities 70s. per ton would be readily accepted. On the North-West Coast, Bessemer mixed numbers are quoted at 72s. 6d. at works.

LANCASHIRE.—The continued depression in the Lancashire textile industry is again reflected in a much restricted demand for pig-iron for local foundry consumers, which is further affected by seasonal influences usually experienced in the holiday months. The recent meeting of the Central Pig-Iron Producers' Association having decided to leave prices undisturbed, quotations still rule at the official rate of 77s. per ton for both Derbyshire and Staffordshire brands of No. 3 foundry, with Scottish brands at 95s., all per ton, delivered local stations.

THE MIDLANDS.—The iron foundry industry throughout the Black Country continues extremely quiet, and market operations as a general rule are confined to hand-to-mouth transactions. Prices are unaltered at 75s. for Northants No. 3 and 78s. 6d. for Derbyshire and North Staffordshire No. 3, with Scotch makes at 93s. 6d. to 94s. 6d., all per ton delivered local stations.

SCOTLAND.—The Scottish pig-iron market, as is to be expected at this season, is exceedingly quiet and is likely to remain so for the next two or three weeks. Buyers are busy stocktaking and not interested in making purchases; pig-iron is in consequence in poor demand. Prices are unchanged on the basis of 76s. 6d. per ton for No. 3 Scotch foundry, f.o.t. furnaces.

Finished Iron.

Manufacturers of this class of material centred in the Black Country area are still only partially employed, the majority of the mills working spasmodically, while orders for substantial tonnages are absent. This position is particularly noticeable in crown and nut and bolt iron, the makers of marked bars being in a somewhat better position. The marked bar makers, of course, do not have to face Continental competition, as there is nothing produced on the Continent comparable with Staffordshire iron of this grade. Marked bars are at £12 10s. at works. The figure for crown bars is between £10 and £10 7s. 6d., and for nut and bolt iron £9 to £9 5s. The Continental works continue to quote very low prices for their product. Bar iron is not controlled by the Cartel, and the Belgian and French prices, delivered to the Darlaston district, are between £5 15s. and £5 18s.

Steel.

The Sheffield steel market is quiet, and business in all sections is slow. The demand for basic billets is, perhaps, slightly better than of late, but for acid billets there is only a poor market, and the same applies to wire rods, both acid and basic. Prices throughout are unchanged. Steel production in this district is receding, and not more than a third of the open-hearth furnaces are in operation at present. There has been a sharp falling away in the demand for motor-car steel, but fortunately there is a good call, both at home and overseas, for special qualities of steel. The tinplate market is also sluggish, with the quotation ruling at 18s. for coke quality, net cash, f.o.b. South Wales ports.

Scrap.

Conditions in markets for foundry scrap metals continue depressed, prices having declined to wholly unprofitable levels. But even at present figures consumers cannot be induced to buy more than very small parcels, and most of the merchants are holding stocks which at the moment are unsaleable. On Tees-side ordinary heavy cast iron might realise 57s. 6d. per ton, but that is the limit, and good machinery quality is quoted at 60s. per ton. In South Wales there is a small but steady demand for heavy cast iron in large pieces and furnace sizes, and prices range from 55s. to 56s. 6d. The local foundries, owing to the general depression in trade, are not busy and the demand for good cast-iron machinery scrap is slow at 57s. 6d. In Scotland, machinery cast-iron scrap is easier at around 63s. 6d., ordinary heavy cast iron about 58s. 6d., steelworks cast iron 56s. 6d., light cast-iron scrap 48s. 6d., and railway chairs 61s. 6d. to 62s. 6d. The above prices are all per ton delivered f.o.t. consumers' works.

Metals.

Copper.—Markets for base metals during the past week have disclosed few outstanding features of more than passing interest, while quotations, though irregular, have only ranged within comparatively narrow limits. On the whole, however, demand has been limited in bulk, and reports on the industrial situation at home and abroad are not very favourable. The problem with copper seems to be the sustaining of consumption at a level which will cope with the production of the next few years.

Closing quotations :—

Cash.—Thursday, £49 to £49 10s.; Friday, £49 to £49 5s.; Monday, £48 12s. 6d. to £48 15s.; Tuesday, £48 5s. to £48 10s.; Wednesday, £47 15s. to £47 17s. 6d.

Three Months. — Thursday, £48 5s. to £48 7s. 6d.; Friday, £48 to £48 2s. 6d.; Monday, £47 15s. to £47 17s. 6d.; Tuesday, £47 17s. 6d. to £48; Wednesday, £47 13s. 9d. to £47 15s.

Tin.—Adversely affected by the June statistics, giving the total increase of visible supplies for the month at 42,611 tons, the week's markets for standard tin have experienced a further spell of low price levels, though partially recovering towards the close. Very little speculative business is in evidence nowadays, and whatever has been accomplished so far in the way of restriction has failed to check the accumulation of supplies which has been going on steadily for well over two years.

Official closing prices :—

Cash.—Thursday, £136 17s. 6d. to £137; Friday, £135 10s. to £135 15s.; Monday, £135 to £135 2s. 6d.; Tuesday, £134 7s. 6d. to £134 10s.; Wednesday, £133 7s. 6d. to £133 10s.

Three Months.—Thursday, £138 15s. to £139; Friday, £137 5s. to £137 7s. 6d.; Monday, £136 15s. to £137; Tuesday, £136 5s. to £136 7s. 6d.; Wednesday, £135 5s. to £135 7s. 6d.

Spelter.—The market for this metal has been easier of late, the price showing a slight decline, which was partly due to less favourable news from America and poor demand from home consumers. It is reported that a meeting is to be held at Ostend on July 15 with a view to the reconstitution of the International Zinc Cartel with the co-operation of America.

Daily fluctuations :—

Ordinary. — Thursday, £15 15s.; Friday, £16 1s. 3d.; Monday, £15 18s. 9d.; Tuesday, £15 15s.; Wednesday, £15 15s.

Lead.—Business in soft foreign pig continues quiet, though fairly steady. Prices have eased slightly, but fluctuations are comparatively unimportant in extent.

The week's prices have been :—

Soft Foreign (Prompt).—Thursday, £17 16s. 3d.; Friday, £18 1s. 3d.; Monday, £18; Tuesday, £18; Wednesday, £18 2s. 6d.

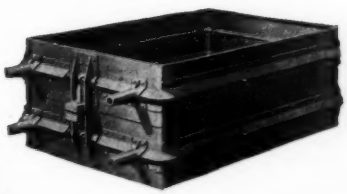
Dorman, Long & Company, Limited.—Messrs. Dorman, Long & Company, Limited, have published a pamphlet giving details of the approximate analyses of their various grades of pig-iron, ferro-alloys, etc. The pamphlet was issued in connection with the Convention of British Foundrymen, recently held in Middlesbrough, and gives a brief history of the firm from 1876 to date. After amalgamation with four of the leading pioneer firms on Tees-side the firm now owns and works 37 blast furnaces producing annually 1,300,000 tons of pig-iron.

GANISTER, CUPOLA BLOCKS, FIRE BRICKS,
FIRE CLAY.
Silica Bricks, Tuyeres, Stoppers, Nozzles, &c.
STEEL MOULDERS' COMPOSITION, SILICA CEMENT.

J. GRAYSON LOWOOD & CO., LTD.
DEEPCAR, nr. SHEFFIELD.
Telegrams: "LOWOOD, DEEPCAR."

Sterling

UP-TO-DATE MOULDING BOX EQUIPMENT.



STERLING
ROLLED STEEL
MOULDING BOXES
have been designed for THE MODERN FOUNDRY.

They are light and easy to handle.
Cannot crack or break.
Cannot spring.
Strong, Rigid, Durable and Permanently accurate.

BY ADOPTING STERLING BOXES IN YOUR FOUNDRY,

You will halve your moulding costs. You will increase production per man per hour, and reduce your box maintenance costs. You will turn out more accurate castings and thereby reduce your scrap and reject accounts. You will considerably reduce your fettling costs and put money into your pocket that is now running to waste.

STERLING BOXES save their cost in a few months and are obviously a sound investment for any foundry.

STERLING FOUNDRY SPECIALTIES Ltd.
Agents at:—London, Manchester, Newcastle and Glasgow.
BEDFORD.

WEEKLY PRICE CURRENT.

COPPER.

	£	s.	d.
Standard cash	47	15	0
Three months	47	13	9
Electrolytic	53	10	0
Tough	53	15	0
Best selected	54	5	0
Sheets	83	0	0
India	67	0	0
Wire bars	56	16	3
Do. August	56	16	3
Do. September	56	16	3
Ingot bars	56	16	3
H.C. wire rods	58	5	0
Off. av. cash, June	50	1	4½
Do., 3 mths., June	50	4	3½
Do., Sttlmnt., June	50	1	3
Do., Electro, June	57	11	9
Do., B.S., June	57	5	7½
Do., wire bars, June	58	8	6
Solid drawn tubes			12d.
Brazed tubes			12d.
Wire			8½d.

BRASS.

Solid drawn tubes	10½d.
Brazed tubes	12½d.
Rods, drawn	10½d.
Rods, extd. or rlld.	6½d.
Sheets to 10 w.g.	9½d.
Wire	9½d.
Rolled metal	8½d.
Yellow metal rods	6½d.
Do. 4 × 4 Squares	7d.
Do. 4 × 3 Sheets	7½d.

TIN.

	£	s.	d.
Standard cash	133	7	6
Three months	135	5	0
English	134	5	0
Bars	136	5	0
Straits	135	10	0
Australian	134	12	6
Eastern	136	15	0
Banca	138	7	6
Off. av. cash, June	136	7	8½
Do., 3 mths., June	138	5	8½
Do., Sttlmt., June	136	7	9

SPELTER.

	£	s.	d.
Ordinary	15	15	0
Remelted	14	15	0
Hard	12	5	0
Electro 99.9	18	9	0
English	16	2	6
India	14	5	0
Zinc dust	21	0	0
Zinc ashes	4	0	0
Off. aver., June	16	14	7½
Aver., spot, June	16	8	5½

LEAD.

	£	s.	d.
Soft foreign ppt.	18	2	6
English	19	10	0
Off. average, June	17	19	4½
Average spot, June	17	18	9½

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	26	0	0
Do. V.M. ex-whf.	25	10	0
Rods	30	0	0
Boiler plates	22	0	0
Battery plates	23	10	0

ANTIMONY.

	£	s.	d.
Special brands, Eng.	38	0	0
Chinese	26	0	0
Crude	20	0	0

QUICKSILVER.

	£	s.	d.
Quicksilver	22	10	0

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro-silicon—	
25%	7 17 6
45/50%	11 10 0
75%	18 10 0
Ferro-vanadium—	
35/50%	12/9 lb. Va.
Ferro-molybdenum—	
70/75% c. free	4/2 lb. Mo.
Ferro-titanium—	
23/25% carbon-free	9d. lb.
Ferro-phosphorus, 20/25%	£16 0 0
Ferro-tungsten—	
80/85%	2/7½ lb.
Tungsten metal powder—	
98/99%	2/10½ lb.
Ferro-chrome—	
2/4% car.	£30 10 0
4/6% car.	£23 10 0
6/8% car.	£22 7 6
8/10% car.	£22 0 0
Ferro-chrome—	
Max. 2% car.	£33 10 0
Max. 1% car.	£36 17 6
Max. 0.70% car.	£37 17 6
70%, carbon-free	11d. lb.
Nickel—99% cubes, or pellets	£175 0 0
Ferro-cobalt	9/7 lb.
Aluminium 98/99%	£95 0 0
Metallic chromium—	
96/98%	2/7 lb.
Ferro-manganese (net)—	
76/80% loose	£10 15 0
76/80% packed	£12 15 0
76/80% export	£10 15 0
Metallic manganese—	
94/96% carbonless	1/7 lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten	£0 2 2
Finished bars, 18% tungsten	£0 3 0

Per lb. net, d/d buyers' works.

Extras—

Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to $\frac{1}{16}$ in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ½ in.	3d. lb.
Do., under ¼ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP.

	£	s.	d.		£	s.	d.
South Wales—							
Heavy steel	2	16	0	to	2	17	0
Bundled steel and shrngs.	2	10	0	to	2	14	0
Mixed iron and steel	2	10	0	to	2	12	6
Heavy cast iron					2	15	0
Good machinery for foundries					2	17	0
Cleveland—							
Heavy steel					2	10	0
Steel turnings					2	4	0
Cast-iron borings					2	0	0
Heavy forge					3	10	0
W.I. piling scrap					3	5	0
Cast-iron scrap	2	17	6	to	3	0	0
Midlands—							
Ord. cast-iron scrap					3	0	0
Heavy wrought					3	5	0
Steel turnings	1	7	6	to	1	10	0
Scotland—							
Heavy steel					2	12	0
Ordinary cast iron					2	18	6
Engineers' turnings					2	1	0
Cast-iron borings					2	0	0
Wrought-iron piling					3	11	6
Heavy machinery					3	3	6

London—Merchants' buying prices delivered yard.

	£	s.	d.
Copper (clean)	43	0	0
Brass	32	0	0
Lead (less usual draft)	15	10	0
Tea lead	12	0	0
Zinc	9	0	0
New aluminium cuttings	60	0	0
Braziery copper	40	0	0
Gunmetal	42	0	0
Hollow pewter	100	0	0
Shaped black pewter	75	0	0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast—	
Foundry No. 1	70/-
Foundry No. 3	67/6
Foundry No. 4	66/6
Forge No. 4	66/-
Hematite No. 1	71/6
Hematite M/Nos.	71/-
N.W. Coast—	
Hem. M/Nos. d/d Glas.	84/-
,, d/d Birm.	90/6
Midlands—	
Staffs. common*	—
,, No. 4 forge*	73/6
,, No. 3 fdry.*	78/6
Shrops. basic	—
,, Cold blast, ord.	—
,, ,, roll iron	—
Northants forge*	70/-
,, fdry. No. 3*	75/-
Derbyshire forge*	73/6
,, fdry. No. 3*	78/6
,, basic*	—
*d/d Black Country dist.	
Scotland—	
Foundry No. 1	79/-
,, No. 3	76/6
Hem. M/Nos.	79/6
Sheffield (d/d district)—	
Derby forge	68/6
,, fdry. No. 3	73/6
Lincs. forge	70/-
,, fdry. No. 3	75/-
E.C. hematite	86/-
W.C. hematite	88/-
Lincs. (at furnaces)—	
Forge No. 4	—
Foundry No. 3	—
Basic	—
Lancashire (d/d eq. Man.)—	
Derby forge	72/-
,, fdry. No. 3	77/-
Staffs foundry No. 3	77/-
Dalzell, No. 3 (special)	105/- to 107/6
Summerlee, No. 3	94/6
Glengarnock, No. 3	—
Gartsherrie, No. 3	94/6
Monkland, No. 3	94/6
Shotts, No. 3	94/6

FINISHED IRON AND STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£	s.	d.		£	s.	d.
Bars (cr.)					10	15	0
Nut and bolt iron	9	0	0	to	9	5	0
Hoops					10	15	0
Marked bars (Staffs) f.o.t.					12	10	0
Gas strip					10	15	0
Bolts and nuts, ¾ in. × 4 in.					15	5	0
Steel—							
Ship plates	8	15	0	to	8	17	6
Boiler plts.	9	15	0	to	10	10	0
Chequer plts.					10	12	6
Angles					8	7	6
Tees					9	7	6
Joists					8	10	0
Rounds and squares, 3 in. to 5½ in.					9	7	6
Rounds under 3 in. to ¾ in. (Untested)					7	17	6
					and upwards		
Flats—8 in. wide and over					8	12	6
,, under 8 in. and over 5 in.					8	17	6
Rails, heavy					8	10	0
Fishplates					12	0	0
Hoops (Staffs)	9	5	0	to	9	15	0
Black sheets, 24 g.					9	15	0
Galv.cor.shts., 24g.					11	17	6
Galv. fencing wire, 8g. plain					12	0	0
Billets, soft	5	17	6	to	6	17	6
Billets, hard	7	10	0	to	8	0	0
Sheet bars	5	15	0	to	6	0	0
Tin bars					6	0	0

PHOSPHOR BRONZE.

	Per lb. basis.
Strip	1/1
Sheet to 10 w.g.	1/1½
Wire	1/2½
Rods	1/2
Tubes	1/6
Castings	1/1½

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. CLIFFORD & SON, LIMITED.

NICKEL SILVER, &c.

	per lb.
Ingots for raising	8d. to 1/2
Rolled—	
To 9 in. wide	1/2 to 1/8
To 12 in. wide	1/2½ to 1/8½
To 15 in. wide	1/2½ to 1/8½
To 18 in. wide	1/3 to 1/9
To 21 in. wide	1/3½ to 1/9½
To 25 in. wide	1/4 to 1/10
Ingots for spoons and forks	8d. to 1/4½
Ingots rolled to spoon size	11d. to 1/7½
Wire round—	
3/0 to 10 G.	1/5½ to 2/0½

with extras according to gauge.

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	19.76
No. 2 foundry, Valley	18.50
No. 2 foundry, Birm.	14.00
Basic	20.26
Bessemer	20.76
Malleable	20.76
Grey forge	19.76
Ferro-mang. 80%	94.00
O.-h. rails, h'y, at mill	43.00
Billets	33.00
Sheet bars	33.00
Wire rods	36.00
	Cents.
Iron bars, Phila.	2.12
Steel bars	1.75
Tank plates	1.70
Beams, etc.	1.70
Skelp, grooved steel	1.80
Skelp, sheared steel	1.80
Steel hoops	2.20
Sheets, black, No. 24	2.55
Sheets, galv., No. 24	3.20
Sheets, blue an'l'd, No. 13	2.15
Wire nails	2.15
Plain wire	2.30
Barbed wire, galv.	2.80
Tinplates, 100-lb. box	$5.25

COKE (at ovens).

Welsh foundry	27/6
,, furnace	18/- to 22/-
Durham and Northumberland—	
,, foundry	14/6 to 15/6
,, furnace	14/- to 14/6
Midlands, foundry	—
,, furnace	—

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 box		18/-
,,	28×20 ,,		36/-
,,	20×10 ,,		26/-
,,	18¼×14 ,,		18/9
C.W.	20×14 ,,		16/6
,,	28×20 ,,		33/6
,,	20×10 ,,		23/6
,,	18¼×14 ,,		17/-
Terneplates	28×20		32/6 per box basis f.o.b.

SWEDISH CHARCOAL IRON & STEEL.

Pig-iron	£6	0	0	to	£7	10	0
Bars, hammered, basis	£17	10	0	to	£18	10	0
Bars and nail-rods, rolled, basis	£15	17	6	to	£16	15	0
Blooms	£10	0	0	to	£12	0	0
Keg steel	£32	0	0	to	£33	0	0
Faggot steel	£20	0	0	to	£24	0	0
Bars and rods dead soft, steel	£11	0	0	to	£14	0	0

All per English ton, f.o.b. Gothenburg.

TUBES AND FITTINGS.

Over ½ in. up to 6 in.

	Tubes.	*Fittings.*
Gas	62½%	47½%
Water ..	58½%	42½%
Steam ..	55%	37½%

W.I. 12½% extra.

DAILY FLUCTUATIONS.

Standard Copper (cash).

		£	s.	d.		
July	3 ..	49	0	0	dec.	13/9
,,	4 ..	49	0	0	No change	
,,	7 ..	48	12	6	dec.	7/6
,,	8 ..	48	5	0	,,	7/6
,,	9 ..	47	15	0	,,	10/-

Electrolytic Copper.

		£	s.	d.		
July	3 ..	54	10	0	No change	
,,	4 ..	54	10	0	,, ,,	
,,	7 ..	54	10	0	,, ,,	
,,	8 ..	54	10	0	,, ,,	
,,	9 ..	53	10	0	dec. 20/-	

Standard Tin (cash).

		£	s.	d.		
July	3 ..	136	17	6	inc.	5/-
,,	4 ..	135	10	0	dec.	27/6
,,	7 ..	135	0	0	,,	10/-
,,	8 ..	134	7	6	,,	12/6
,,	9 ..	133	7	6	,,	20/-

Tin (English ingots).

		£	s.	d.		
July	3 ..	137	10	0	dec.	15/-
,,	4 ..	136	0	0	,,	30/-
,,	7 ..	135	15	0	,,	5/-
,,	8 ..	135	5	0	,,	10/-
,,	9 ..	134	5	0	,,	20/-

Zinc Sheets (English).

		£	s.	d.		
July	3 ..	27	0	0	No	change
,,	4 ..	26	0	0	dec.	20/-
,,	7 ..	26	0	0	No	change
,,	8 ..	26	0	0	,,	,,
,,	9 ..	26	0	0	,,	,,

Spelter (ordinary).

		£	s.	d.		
July	3 ..	15	15	0	dec.	1/3
,,	4 ..	16	1	3	inc.	6/3
,,	7 ..	15	18	9	dec.	2/6
,,	8 ..	15	15	0	,,	3/9
,,	9 ..	15	15	0	No change	

Lead (English).

		£	s.	d.		
July	3 ..	19	5	0	No change	
,,	4 ..	19	10	0	inc.	5/-
,,	7 ..	19	10	0	No change	
,,	8 ..	19	10	0	,,	,,
,,	9 ..	19	10	0	,,	,,

AVERAGE MONTHLY PRICES OF RUBIO ORE (MIDDLESBROUGH).

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1890	0 15 4	0 15 4	0 15 4	0 15 4	0 15 4	0 15 4	0 15 4	0 14 3	0 14 3	0 15 7½	0 15 7½	0 15 7½	0 15 2½
1891	0 15 7½	0 14 2½	0 14 2½	0 14 2½	0 13 6½	0 13 6	0 13 3½	0 13 0	0 12 11	0 13 0	0 13 7	0 13 1	0 14 9½
1892	0 13 1	0 12 9	0 12 9	0 12 9	0 12 9	0 11 10½	0 12 1	0 12 1	0 12 2	0 12 0	0 12 0	0 11 11	0 12 4½
1893	0 11 11	0 11 5½	0 11 10	0 11 10	0 12 1½	0 12 3	0 12 1½	0 12 3	0 12 1	0 12 4	0 12 4½	0 12 6	0 12 0½
1894	0 12 6	0 12 6	0 12 7½	0 12 1½	0 12 4	0 12 1	0 12 0	0 12 0½	0 11 10½	0 12 2	0 12 0	0 12 0	0 12 1½
1895	0 12 0	0 12 0	0 11 10	0 12 0	0 12 9	0 12 3	0 12 3	0 12 4	0 12 4	0 12 6	0 12 7	0 12 6	0 12 2½
1896	0 12 6	0 12 6	0 12 9	0 12 9	0 12 9	0 12 7	0 12 9	0 12 9	0 12 9	0 13 6	0 15 0	0 14 9	0 13 1
1897	0 15 3	0 15 6	0 15 3	0 15 0	0 14 0	0 14 3	0 14 3	0 14 0	0 14 0	0 15 0	0 14 3	0 15 3	0 14 8
1898	0 15 0	0 14 4	0 14 9	0 14 6	0 15 0	0 15 0	0 14 0	0 14 0	0 14 0	0 14 9	0 15 0	0 14 9	0 14 7
1899	0 15 0	0 15 3	0 15 6	0 15 6	0 15 9	0 16 0	0 17 6	0 18 0	0 17 9	0 18 0	0 19 0	1 0 0	0 16 11½
1900	1 1 0	1 0 6	1 1 0	1 0 9	1 1 0	1 1 0	1 1 3	1 1 6	1 1 3	1 1 0	1 0 0	0 18 0	1 0 8½
1901	0 17 6	0 16 0	0 16 0	0 14 6	0 15 6	0 15 9	0 14 9	0 15 3	0 15 9	0 15 9	0 15 9	0 15 9	0 15 7½
1902	0 15 6	0 15 0	0 16 0	0 16 0	0 15 6	0 15 3	0 15 6	0 16 0	0 16 0	0 16 0	0 15 9	0 15 6	0 15 8½
1903	0 15 6	0 16 0	0 16 6	0 16 3	0 15 3	0 16 10	0 15 9	0 15 6	0 15 6	0 14 9	0 14 9	0 15 1	0 15 8
1904	0 14 9	0 15 3	0 15 1	0 15 4	0 15 3	0 15 0	0 14 5	0 14 6	0 14 6	0 14 6	0 14 6	0 14 7	0 14 9½
1905	0 15 3	0 15 6	0 15 0	0 15 3	0 15 6	0 15 6	0 15 6	0 15 6	0 16 6	0 18 6	0 18 9	0 18 9	0 16 3½
1906	1 0 0	1 1 6	1 0 0	1 0 0	0 19 6	1 0 0	0 19 6	0 19 4	1 0 6	1 1 6	1 1 9	1 3 6	1 0 7
1907	1 3 6	1 2 6	1 2 6	1 2 0	1 1 6	1 2 3	1 2 3	1 2 0	1 1 0	0 19 0	0 18 9	0 17 6	1 1 2½
1908	0 16 6	0 15 0	0 15 6	0 15 6	0 15 3	0 15 0	0 15 0	0 14 9	0 15 0	0 16 0	0 16 0	0 16 0	0 15 5½
1909	0 15 9	0 16 3	0 16 0	0 16 0	0 16 3	0 16 6	0 16 0	0 16 0	0 17 0	0 17 0	0 17 6	0 17 6	0 16 6
1910	1 0 4	1 0 9	1 0 9	1 0 9	1 0 9	1 0 9	1 0 9	1 0 3	1 0 3	1 0 6½	1 1 3	1 1 5	1 0 9½
1911	1 2 2½	1 2 6	1 2 6	1 1 11½	1 0 11½	1 0 6	0 19 6	0 19 0	0 19 1½	0 19 6	1 0 0½	1 1 6½	1 0 7½
1912	1 2 3	1 2 6	1 2 6	1 1 1½	1 1 6	1 1 6	1 1 6	1 2 3	1 2 6	1 3 0	1 3 0	1 2 11	1 2 2½
1913	1 2 9	1 2 2	1 1 7½	1 1 6	1 0 8½	1 0 0	1 0 0	1 0 0	0 19 10½	0 19 1½	0 19 0	0 19 0	1 0 5½
1914	0 18 7½	0 18 0	0 18 0	0 17 9	0 17 6	0 17 6	0 17 1½	0 19 7½	0 18 11½	0 17 10½	0 18 7½	1 1 0½	0 18 5½
1915	1 7 7½	1 8 6	1 9 3	1 10 2½	1 8 6	1 6 4	1 5 10½	1 6 0	1 6 10½	1 10 8½	1 13 0	1 17 10	1 9 1½
1916	1 18 6	2 0 1½	2 2 6½	2 0 6½	1 15 0	1 16 3	1 18 0	1 18 0	1 18 0	—	—	—	—
1917	} Price Fixed												
1918													
1919	—	—	—	—	2 5 7½	2 14 4½	2 16 4½	2 14 0	2 13 4½	2 13 0	2 12 7½	2 11 9	—
1920	2 17 0	3 7 9	2 15 6	3 6 7	3 0 0	2 15 0	2 14 0	2 9 9	2 7 6	2 11 0	2 12 3	2 10 0	2 15 0
1921	2 1 0	2 0 1½	1 18 3	1 17 6	1 17 6	1 17 6	1 17 6	1 5 0	1 8 9½	1 7 9	1 7 0	1 7 0	1 13 8½
1922	1 6 7½	1 5 10½	1 6 11	1 7 0	1 7 0	1 7 0	1 5 3	1 4 9½	1 4 2½	1 3 3½	1 2 6	1 2 3	1 5 2½
1923	1 2 9½	1 4 6½	1 5 2	1 4 8½	1 4 6	1 4 0	1 3 6	1 3 0	1 3 0	1 3 0	1 3 2½	1 4 9	1 3 10½
1924	1 4 2½	1 4 0	1 4 0	1 3 7½	1 3 8½	1 3 6	1 2 11	1 2 6	1 2 1½	1 1 7½	1 2 3	1 2 6	1 3 1
1925	1 2 6	1 2 1½	1 2 0	1 2 0	1 2 0	1 1 6	1 0 6	1 0 0	1 0 0	1 0 0	1 0 3	1 0 10½	1 1 1½
1926	1 1 1½	1 1 6	1 1 6	1 1 3½	1 1 3	1 1 5½	1 1 6	1 1 6*	1 1 0*	1 1 6*	1 1 6*	*	1 1 4½
1927	1 2 1½	1 2 3	1 2 1½	1 2 0	1 2 0	1 2 0	1 1 7½	1 1 0	1 1 0	1 1 0	1 1 0	1 1 0	1 1 7½
1928	1 1 0	1 1 1½	1 1 11	1 2 4½	1 2 6	1 2 6	1 2 6	1 2 6	1 2 6	1 2 6	1 2 6	1 2 6	1 2 2½
1929	1 2 6	1 2 6½	1 2 11½	1 3 0	1 3 0	1 3 2½	1 4 0	1 4 8½	1 4 7½	1 4 6	1 4 6	1 4 3	1 3 7½
1930	1 3 3½	1 2 6	1 1 9	1 1 6	1 0 10½	1 0 0	—	—	—	—	—	—	—

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